A Case Study of Hydraulic Fracturing in Wetzel County, West Virginia

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This thesis titled
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ABSTRACT

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This case study conducted in Wetzel County, West Virginia, explores the impacts of unconventional natural gas development in a small rural community located in the Marcellus Shale formation. In-depth, semi-structured interviews conducted with members of this community explored the impacts associated with this activity. Interviews were analyzed using qualitative methods following standard case study procedures. Major impacts consist of a variety of closely interrelated economic, environmental, and social impacts, including an overall decrease in quality of life. Residents’ perceptions of these impacts varied, frequently in relation to whether the resident is personally benefitting financially from the development. An unequal distribution of the benefits and burdens of natural gas development was found to be experienced by the community. The experiences of this community fit within the broader picture of energy development within the Appalachian region.
DEDICATION

*This thesis is dedicated to the residents of Wetzel County, and similar communities throughout Appalachia.*
ACKNOWLEDGMENTS

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CHAPTER 1: INTRODUCTION

I first arrived in the town of New Martinsville on a hot, late summer day. My drive up was pleasant, traveling along scenic country roads. As I neared the town I noticed increasingly more truck traffic. I passed a series of motels, each displaying NO VACANCY in flamboyant red letters. Pulling off at a gas station, the passing traffic was relentlessly noisy. Stepping out of my car, the first thing to catch my eye was a giant Stone Energy sign. Entering the gas station, I found a long line of young men dressed in muddy clothes and work boots. I had arrived at a natural gas boomtown.

Before I began my interviews, I did not know whether I would hear tales of a flourishing industry saving what had been a dying town and creating millionaires overnight, or fantastical stories of water faucets bursting into flames. The truth I was told and observed suggests a gray zone lying in the middle of these extremes, with lines drawn between the winners and losers of this energy development (personal observation, August 25, 2012).

Background

The Appalachian region has undergone a long history of exploitative resource extraction for energy sources (Scanlan, 2011; Glasmeier & Farrigan, 2003). Poverty and environmental contamination is rampant in this resource rich region, creating a vast disconnect between the costs and benefits of this extractive activity with the benefits mainly experienced outside of the region (Scanlan, 2011). It has been described as a
“national sacrifice zone,” where natural resources are extracted to supply the energy needs of the country, at the detriment to the local people and communities (Buckley & Allen, 2011; Scanlan, 2011). This has occurred in regard to timber, coal, oil, and recently with natural gas. The focus of this case study is to investigate the impacts of the extractive activities of unconventional natural gas development within the rural Appalachian community of Wetzel County, West Virginia, and analyze how this is changing quality of life and a sense of community.

*High-volume Horizontal Hydraulic Fracturing*

The exploitation of natural resources in the Appalachian region continues today with the extraction of natural gas from deep shale deposits. High-volume horizontal hydraulic fracturing, a form of “unconventional gas production”, began to be used at a commercial scale in shale formations during the 1990s, with development rapidly increasing over the past decade (USEPA, 2012b, para. 4; NYSDEC, 2011). The process of fracturing rock to release trapped gas or oil has been used for vertical wells since the 1940s, while horizontal drilling, first developed in the 1930s, has been experimented with in shale by the Department of Energy since the 1970s (USEPA, 2012b; Waples, 2012). Mitchel Energy and Development began testing these processes in deep shale gas formations in 1981, with the Barnett Shale in Texas. Eventually the company found the mixture of water and chemicals used in high-volume horizontal hydraulic fracturing today, and merged with Devon Energy Corporation in 2002. The Barnett Shale was produced throughout the 1990s. Beginning in 2004, unconventional shale drilling moved
to new formations, including the Marcellus Shale in the Appalachian Basin (Waples, 2012) (see Figure 1).

The process of high-volume horizontal hydraulic fracturing uses a mixture of water, sand, and chemicals under high pressure to overcome formation pressure and create fractures in the rock structure, releasing the trapped natural gas, and allows for the horizontal expansion of wells which increases the volume of gas produced. The technological advances of this procedure have allowed for the profitable extraction of natural gas from tight geological formations such as shale (USEPA, 2012b). According to the U.S. Energy Information Administration (EIA) (2012), natural gas production in the United States is projected to increase 44 percent by 2040, to 33.1 trillion cubic feet of natural gas, with the majority of this from shale gas. The Marcellus shale formation runs beneath 60 million acres of Appalachia and is estimated to hold trillions of cubic feet of natural gas (USEPA, 2012a; Waples, 2012). The Marcellus “fairway” (“area of economic extraction”) lies from 4,000 to 8,500 feet below the surface within Pennsylvania, Ohio, West Virginia, Virginia, Maryland, Kentucky, and Tennessee (Waples, 2012, p.230).

Horizontal drilling begins in the same manner as vertical wells, with drilling to a depth below the deepest groundwater aquifer (Waples, 2012). Typically there is then one layer of steel surface casing placed to protect groundwater. Other intermediate steel casings are placed to prevent interaction with formations such as deep salient aquifers. Production casing is laid the entire length of the drilled well, and back out of the well. Each layer has cement pumped down between the steel casing and the rock.
layers of cement are then pumped into the well and forced under high pressure up the outside of the steel casing to the surface in order to provide further protection from groundwater. This cement forms a plug that has to be drilled through (USEPA, 2012b). The drill bit then begins to turn horizontally along a long radius. This horizontal pipe can stretch over a mile (Waples, 2012). According to Waples (2012), “Multiple wells only a dozen feet apart can be drilled on the same pad to offshoot into different horizontal directions to eventually cover a square mile of shale, vastly reducing the overall environmental footprint of the wells” (p. 243). This allows for greatly increased gas production from each well pad.

After the horizontal well is drilled, the process of hydraulic fracturing occurs over two main phases: perforation and “fracking” (USEPA, 2012b; Waples, 2012). Perforation begins with a perforating gun being inserted at the end of the horizontal drill pipe, and set off with explosives to create holes in the casing and surrounding shale. While variation exists in the process, fracking typically occurs over four stages: an acid stage to clear an opening for the frack fluids; a pad stage with “slickwater” (which typically contains a proppant and a gelling agent to keep the proppant suspended) to fracture the shale; a prop stage using water and proppants to hold the fractures open; and a flushing stage to eject excess proppant. Frack fluids are typically composed of around 90 percent water, 9 percent sand, and between 0.5 and 2 percent chemicals, and are pumped into the well at around 8,000 psi (Waples, 2012). Each Marcellus well uses three to five million gallon of water, as compared to 100,000 gallons for conventional wells (USEPA, 2012b; Waples, 2012). A well is “perfed” and “fracked” up to 12 times, with a
heavy plug placed between each stage. After fracturing, the well needs to be shut until the fractures are stable, and then “flowback” fracturing fluid returns to the surface. This process of well completion includes the flaring (controlled burning) of natural gas for production testing (Waples, 2012, p.245-246).

The EPA’s Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water: Progress Report (2012) includes a list of over 1,000 chemicals used in fracking fluids, as companies use different formulas. Various hazardous chemicals are used in this process, many of which are still unknown due to company proprietary information protections (USEPA, 2012c; Earth Works, 2005). Frack water typically includes surfactants, biocides, scale inhibitors, friction reducers, proppants, and gelling agents in order to make the water thick and slick enough to suspend the proppants and quicken flow through the drill pipe (Waples, 2012). Chemicals used in the process include hydrochloric acid, acetaldehyde, sodium chloride, polyacrylamide, sodium polycarboxylate, ethylene glycol, borate salts, and isopropanol, along with hundreds of others (Waples, 2012; Frac Focus, 2013).

In order to be economically viable, a shale gas play needs an ideal range for the following properties: total organic carbon (TOC), thickness, depth of burial, thermal maturity, and porosity/permeability (EIA, 1993; Waples, 2012). The Marcellus Shale is such a successful gas producer because in addition to having these ideal properties, it has “one of the finest natural fracture sets among the active gas shale plays in the U.S.”, which increases production. (Waples, 2012, p. 231)
Exploratory gas drilling began in the Marcellus Shale in 2005, with Pennsylvania being the most heavily developed. This created a frenzy of buying and selling leases in the region, with the majority of landowners following a “standard industry lease” of five years with the option of extension, at a minimum 12.5 percent royalty rate (Waples, 2012, p. 235). These leases greatly changed the land value in the region, in some cases changing from $2,000 per acre to $10,000 per acre. Drilling leases typically involve mineral rights, and not a lease of the land (Waples, 2012).

The sudden explosion of the natural gas industry has resulted in both new opportunities and challenges for the rural communities where these unconventional natural gas wells are being constructed. This can create tension within communities among those with differing opinions on the consequences of this activity. Additionally, the impacts of high-volume horizontal hydraulic fracturing raise issues in relation to the burden placed on rural communities for the extraction of energy resources.

Research Questions

The research questions for this thesis focus on the impacts of energy extraction to rural communities through a case study analysis. Specifically:

- What are residents’ perceptions of the impacts of unconventional natural gas development, and what factors cause variation in these views?

These research questions were developed from the literature review in the following chapter.
Significance

While there has been a recent emergence in studies on the environmental and economic impacts of high-volume horizontal hydraulic fracturing for natural gas, little research has been conducted on the everyday impacts to the residents of the rural communities where this extractive industry is occurring. Existing research in regards to community perspectives of the impacts has stressed the need for further research to build upon this knowledge (Brasier et al., 2011; Theodori, 2009). These studies investigate possible strains and changes within these communities due to the rapid industrialization they are experiencing. These social consequences of energy extraction are important to understand in order to gain a complete picture of the impacts of resource extraction for energy, and are closely intertwined with the environmental and economic impacts.

This case study will tie into the long history of exploitative resource extraction that has occurred in the Appalachian region (Glasmeier & Farrigan, 2003; Scanlan, 2011). While the technology has grown more advanced, many of the same basic impacts of this exploitation are being experienced by the local communities as were experienced historically from such activity as coal mining. In a region with a high level of poverty and environmental pollution, the Appalachian people have been burdened by resource extraction to provide energy for the rest of the nation; thus Appalachia has been described as a national sacrifice zone (Scanlan, 2011). This study tells a piece of that story, through the words of the residents of the natural gas boomtown of Wetzel County, West Virginia.
CHAPTER 2: IMPACTS OF ENERGY EXTRACTION ON RURAL COMMUNITIES

An abundance of literature exists regarding the impacts of boom-bust cycles in rural communities due to the extraction of natural resources such as coal, oil, and natural gas. Much of this research was conducted in communities located in the western United States. Previous studies on energy development in rural communities have found various socio-cultural impacts of the industrial activity, many of which are linked to rapid population changes. These tend to involve disruptions to everyday life, particularly in regards to the rural lifestyle that is valued by residents (Jacquet, 2009; Brown et al., 2005; Merrifield, 1984; Gilmore, 1976). Recently, literature has been published specifically studying the impacts of high-volume horizontal hydraulic fracturing (fracking) for natural gas or shale oil, focusing on the perceptions of residents (Brasier et al., 2011; Jacquet, 2009).

Environmental, economic, and social impacts of resource extraction were identified in various studies (Brasier et al., 2011; Mayda, 2011; Jacquet, 2009; Brown et al., 2005; Merrifield, 1984; Albrecht, 1978; Gilmore 1976). Economic impacts follow the typical boom-bust cycle. Boom-bust cycles in rural areas undergoing energy development create periods of stability, rapid growth, and decline, all of which impact communities (Brown et al., 2005). These economic cycles cause population growth and decline in these regions, with resulting social change due to the changing demographics (Ilbery, 1998). Environmental impacts associated with unconventional natural gas development include air pollution, water contamination, overwithdrawal of water, increased runoff, subsidence of soil, and a possible link to the creation of earthquakes.
(USEPA, 2012c; New York Riverkeeper, 2010). Water contamination concerns surround the storage of chemical-laden wastewater produced from this process, possible spills, as well as the unpredictable migration of natural gas and fracking brine within the shale rock fractures (USEPA, 2012c; GAO, 2012a; Earth Works, 2005). These impacts can affect wildlife, disrupt the hydrologic cycle, and pose a threat to human health. Aesthetic issues also surface in rural countryside that undergoes this form of industrialization (Brasier et al., 2011).

A recent boom has occurred due to the development of the process of horizontal high-volume hydraulic fracturing for natural gas. Research into rural communities experiencing development due to this natural gas boom is finding many of the same issues experienced by past energy boomtowns, resulting primarily from rapid population change. There are also significant new trends emerging that distinguish modern natural gas boomtowns from energy boomtowns of the past.

**Historical Background: Western Boomtowns**

A handful of case studies were conducted during the 1970s and 1980s on energy boomtowns in the American West, for either oil or natural gas development. This research lays the foundation of knowledge on the impacts of rapid population change and industrialization within small rural communities, and led to the development of the *Boomtown Impact Model* (Jacquet, 2009, p. 1). This model shows that rural regions can be overwhelmed by the population increase accompanying energy development. Gilmore’s (1976) research on western boomtowns described the degraded quality of life
resulting from rapid population increase, and discussed the need for growth management. There are four main stages that communities experiencing an energy boom tend to undergo in response to the rapid population change: enthusiasm, uncertainty, near panic, and adaptation (Jacquet, 2009). The first stage of enthusiasm is the result of promises of economic development and new jobs. Uncertainty and panic result as the impacts of the influx of a large population are experienced. Adaptation is dependent upon various factors in a community, with certain communities being better able to mitigate the impacts of rapid population change.

The research conducted in early western boomtowns found a variety of socio-cultural impacts associated with rapid development in rural regions, which amount to a decrease in quality of life for residents. (Gilmore, 1976; Kassover and McKeown, 1981; Merrifield, 1984; Brown et al., 2005; Jacquet, 2009). A sense of community may also be at jeopardy (Albrecht, 1976). Albrecht (1976) divides socio-cultural impacts into the following categories: interpersonal, family, community; social service delivery; physical environment with quality of life implications. These impacts mainly stem from the rapid population growth experienced in these rural regions (Albrecht, 1976). Many studies have overlooked the social consequences of this development, as well as long-term and indirect costs (Gilmore, 1976; Kassover and McKeown, 1981; Merrifield, 1984; Jacquet, 2009). Case studies found that population growth put a major strain on local government resources, with problems including: lack of information, growth instability, lack of jurisdiction, conflict between long-term residents and new residents, resistance to new government policy or planning strategies, shortage of staff or expertise, and a lack of
adequate revenue. Economic impacts are typically mixed, with certain areas receiving more of a benefit than others. Frequently, expectations for economic and job growth are higher than the reality (Jacquet, 2009).

Social problems that may result from rapid population growth in small communities include crime, mental health problems, community dissatisfaction, and education shortfalls. Generally, residents experience increased stress and decreased quality of life (Kassover and McKeown, 1981). Social reactions are place-specific and dependent on such factors as length of residence and status within the community. The changes that occurred within these communities were directly linked to population growth, and the inability of local resources to manage the rapid change (Jacquet, 2009).

A case study conducted by Merrifield (1984) found that between 1970 and 1980, Wyoming’s population grew by 41 percent. This has been attributed to the rise in energy boomtowns in the region for the development of oil, gas, coal, and uranium. The towns of Gillette and Rock Springs doubled in population during this time (Merrifield, 1984). Western boomtowns typically reach their peak population during the construction of an energy development project, then decline slightly during the operation of the project, with post-boom populations remaining higher than the pre-boom population (Jacquet, 2009). This shows long-lasting demographic changes in communities experiencing energy development.

The rapid rise in population requires certain mitigation measures, such as increased investment in infrastructure and municipal services (Merrifield, 1984; Jacquet, 2009). In *Energy Boomtowns & Natural Gas: Implications for Marcellus Shale Local*
Governments & Rural Communities, Jacquet (2009) discusses how it is difficult for communities to prepare for the population changes that energy development brings, as projects are unpredictable with industry cancelling plans or rapidly moving into an area. This can leave communities unprepared for growth, or create debt when investments are made for a project that never unfolds. An additional problem arises from jurisdictional mismatch, where an energy project is located in a remote rural region, yet workers live in the nearest city or large town (Jacquet, 2009). This shows the difficulty in applying standard mitigation measures to communities expecting rapid energy development.

Early boomtown literature has been criticized for lacking baseline data, which can create exaggerations of reported impacts, along with an overreliance on the use of anecdotal accounts (Brown et al., 2005; Jacquet, 2009). Merrifield (1984) acknowledges a lack of concrete scientific data regarding the impacts of energy boomtowns, and therefore the need for further analysis. Additionally, the generic application of the Boomtown Impact Model does not account for the unique historical or cultural factors of particular communities (Jacquet, 2009). This shows the need for in-depth case studies regarding recent natural gas development, using a combination of qualitative and quantitative research methods.

Natural Gas Boomtowns of Today

With the emergence of a booming natural gas industry since the 1990s there has been a recent surge in studies on modern boomtowns, and a consideration of the impacts associated with this development beyond purely economic or environmental
considerations (Brasier et al., 2011). Natural gas boomtowns of today share many similarities with the western boomtowns studied in early literature, but also exhibit unique characteristics. It is evident that natural gas energy development is changing the population growth rates and demographics of small rural communities.

Population Growth

It is difficult to accurately predict population growth levels in rural communities experiencing energy development. This adds to the challenge of preparing for the impacts of rapid population change. Population growth rates above six percent are likely to be problematic for local governments, with rates above 15 percent causing major breakdowns in services (Jacquet, 2009). The majority of the population influx tends to be to larger communities within a region, even when this means longer commutes to project sites, due to the fact that these areas are able to provide a wider range of amenities (Jacquet, 2009).

Wyoming experienced a 14.1 percent increase in population during the past decade, with most of the growth occurring in rural areas undergoing natural gas development. Sublette County experienced the largest growth, at 73 percent (Eversley, 2011). A case study of Sublette County found that the permanent population grew by five percent in 2005, and nine percent in 2006, with the majority of these immigrants being employed by the energy industry (Jacquet, 2009). A case study conducted in the Barnett Shale of Texas found increases in the population of two counties experiencing natural gas development; between 2000 and 2005, Wise County grew by 14.3 percent, while Johnson County grew by 13.5 percent (Theodori, 2009). A case study conducted
on the oil and natural gas boomtown of Fort St. John, British Columbia, in 2008 found a population increase of 8.4 percent since the energy development began. The majority of these immigrants are young workers seeking employment with the oil or natural gas industry (Goldenberg et al., 2009). The reported census numbers only include new permanent residents, and not the transient workforce.

**New Demographic Trends**

Energy boomtowns tend to experience different demographics than what previously existed within the rural community; they also exhibit certain trends that differ from regional or national averages. For the past few decades, remote rural communities in the United States have been typified by racial/ethnic homogeneity and an aging population as youth leave for job opportunities in urban areas (Ilbery, 1998; Jacquet, 2009). Boomtowns typically have larger young male populations, and can also be more ethnically or racially diverse (Jacquet, 2009; Brasier et al., 2011). If migrants have different cultural and socio-economic characteristics than the resident population, social change may occur, a phenomenon known as replacement selectivity (Ilbery, 1998). This is also likely to create conflict within communities.

According the U.S. Census, a 128 percent increase in residents within the age bracket of 20-29 was experienced in Sublette County, Wyoming, between 2000 and 2007. During this same time period, the number of males living in the county increased by three percent, and the percentage of Hispanics living in the county increased from 1.8 percent to 3.8 percent of the total population. These statistics only account for permanent residents, and not transient workforces (Jacquet, 2009).
The energy boomtown of Fort St. John, British Columbia, experienced population growth within the age group of 15-29 at three times the national average. In addition, the sex ratio is skewed at 107.2 males for every 100 females, compared with an average of 98.3 for British Columbia (Goldenberg et al., 2009). These sudden demographic shifts can result in social disruption within small communities.

Transient Workforce

It is difficult to find data on the transient workers involved in natural gas development projects because energy companies contract much of the work involved out to a variety of contractors. Based on anecdotal evidence, the demographics of transient natural gas workers include mostly white men in their 20s and 30s (Jacquet, 2009). The Sublette County case study found that the transient workforce for the natural gas development projects increased the population of the county by an average of 21 percent at any given time. The crews typically rotated in one or two week shifts, and therefore lived in “non-traditional housing units” such as employer dormitories, RVs, or motels (Jacquet, 2009, p. 31). Employment opportunities are often limited for long-time residents, as they require specialized skills. Therefore, outsiders migrating into the area, such as members of construction or drilling crews, tend to be better suited for the available jobs, and therefore receive the greatest benefit from the energy development, providing a push factor for migration into the community (Jacquet, 2009). While transient workers are not counted as residents, they still create a demographic shift within communities.
The population migrating into a boomtown often faces social difficulties, including poor living conditions, stress from moving to a new area, and social isolation from established residents. Newcomers are composed of both transient workers for the initial construction of the project, and permanent newcomers who are involved in the long-term maintenance of the project. Transient workers also hold a range of socioeconomic backgrounds. Women and families sometimes follow their husbands into the boomtown, and have been found to face even greater hardships than the male-dominated workers (Jacquet, 2009). The migration of workers into small communities also creates a variety of impacts for residents.

Impacts of Rapid Industrialization

Case studies have shown that current natural gas development can result in many of the same issues found from the Boomtown Impact Model (Jacquet, 2009). The 2008 study conducted in Sublette County concluded the following:

The natural gas drilling process requires substantial populations of transient workforces as well as resident workforces that put strains on housing and government services. Inflation and other cost of living pressures in Sublette County appear similar to pressures described in the classic boomtown model, as is the realization of significant gains in job and economic growth for those persons able to participate in sectors related to the energy industry (Jacquet, 2009, p. 2).

As was discovered in early research, these impacts in small rural communities cause an overall decline in quality of life, in addition to major economic changes (Jacquet, 2009).
A variety of economic changes occur in communities experiencing a natural gas boom (Brown et al., 2005; Jacquet, 2009; Goldenberg et al., 2011; Brasier et al., 2011; Mayda, 2011). Economic benefits include an increased tax base, royalties for land owners, and new employment opportunities. A boom in local businesses does tend to occur with the influx of new customers, although business owners have to contend with inflation and changing ways of conducting business. For instance, small business owners in Bradford, Pennsylvania, described changing business hours in order to accommodate the twelve hour shifts of workers (Legere, 2009). Land values, housing/rental prices, and tax rates all tend to increase (Jacquet, 2009). Natural gas companies often contribute financially to community projects in rural areas where they are based. In Trinidad, Colorado, the company Evergreen Resources makes annual donations of over $100,000 to local services and art programs (Garrett, 2003). This may be seen as an attempt to ease the friction that develops between new workers in a community and the long-time residents.

A shortage of housing is a major problem typical of boomtowns (Brown et al., 2005; Jacquet, 2009; Goldenberg et al., 2011; Brasier et al., 2011; Mayda, 2011). Newcomers tend to end up living in mobile homes. Since housing and rental prices often skyrocket, this can force working crews to live in outside communities and have long commute times, as well as give an incentive for current residents to move away (Jacquet, 2009; Goldenberg et al., 2009). North Dakota, which has seen a major boom due to the shale oil industry, has experienced severe housing shortages in small towns. In the town of Williston, tent and RV villages have sprung up, and the local Wal-Mart even sells
modular dwellings that can be moved by forklift (Karaim, 2012). One reporter describes the following scene:

   The city is sprawling in every direction--new housing developments, oil derricks, metal industrial buildings, temporary housing called man camps--a crazy quilt that reaches far into the countryside. (Karaim, 2012, p. 123).

The rapid population increase has resulted in sudden changes to land values and the labor market, as well as burdening infrastructure and services. Residents complain about the loss of a quiet, peaceful rural lifestyle as the region undergoes rapid industrialization (Karaim, 2012).

   Recently, literature has been published specifically studying the social impacts of unconventional natural gas development, focusing on the perceptions of residents (Shriver and Webb, 2009; Brasier et al., 2011, Theodori, 2009). The case studies by Brasier et al. (2011) and Theodori (2009) both investigated residents’ perceptions to the impacts of unconventional natural gas development. While their methods differed, both arrived at certain overlapping conclusions. Specific social impacts identified from natural gas development in rural communities often stemmed from a rapid population increase, including: increased demand on social services, increased diversity with resulting cultural differences, increased tension between class differences, and conflict and polarization between neighbors receiving unequal benefits from leases or with differing opinions on hydraulic fracturing (Brown et al., 2005; Jacquet, 2009; Brasier et al., 2011). A clear division was also seen between rural areas and urban centers, with rural residents receiving more of the negative impacts of extractive activity, and urban
areas receiving an increased tax base (Brasier et al., 2011). Degraded infrastructure, particularly from increased truck traffic, impacted everyday life for residents (Brasier et al., 2011; Jacquet, 2009; Theodori, 2009). Additional impacts include increased crime, overcrowded schools, higher stress, and problems of drug abuse and the spread of sexually transmitted diseases with the influx of a young working population (Jacquet, 2009; Goldenberg et al., 2009). Brown et al. (2005) claim that pre-conceived notions on energy development may impact the attitude of residents, creating a variation in perceived impacts.

Within communities, the changes that occur resemble the lifestyle of urban areas, as opposed to the previous rural environment. A study conducted by Brown et al. (2005) on the energy boomtown of Delta, Utah, found an inverse relationship between community satisfaction and population growth, with anticipatory responses and individual perspectives also acting as significant factors. Residents’ individual perceptions in regards to the impacts being experienced within communities can vary greatly (Theodori, 2009). For instance, elderly residents may receive greater difficulty in dealing with social and economic changes, due to fixed incomes and less adaptability to social change (Jacquet, 2009). This adds to the complexity of understanding the impacts of energy development within rural communities.

Social capital, the “development and use of social bonds and networks as resources to facilitate productive activity” can undergo change in rural communities experiencing rapid industrialization (Sampson et al., 2011, p. 98). Major components of social capital include trust and reciprocity (Sampson et al., 2011). Rural communities
tend to have higher levels of social capital (Sampson et al., 2011). Yet West Virginia, despite being predominately rural, has low levels of social capital (Bell, 2009). This may be explained by the impacts of the high level of industrialization and extractive activities within rural areas of West Virginia (Bell, 2009). This suggests that extractive activities result in long-term impacts to community function.

Geographical Considerations

The different geography involved in current natural gas development creates significant discrepancies from early boomtown literature that need to be considered. The largest regions of the United States experiencing rapid shale gas development include the Barnett Shale in Texas and the Marcellus Shale in the Eastern United States (EIA, 2010; See Figure 1). The Marcellus Shale region in particular exhibits important differences from the types of communities included in past western boomtown case studies, mainly due to population size and density, and historical and cultural dissimilarities (Jacquet, 2009). Much of the Marcellus Shale runs beneath the Appalachian region of the United States, which has already experienced a long history of resource extraction, and maintains a distinct culture from remote areas of the West (See Figure 1 and Figure 2). Differences in land ownership laws are also significant, as the Appalachian region frequently has separate land and mineral rights due to its history of coal mining. This can lead to increased tensions within communities regarding landowners who do not own their mineral rights and thus have no legal power to prevent development on their property. In addition, the eastern part of the United States is more densely populated than the western part of the country, with hydraulic fracturing activity increasingly encroaching on
suburban areas. Therefore, applying boom and bust cycle literature to hydraulic fracturing in the Marcellus Shale requires an understanding of the differences between traditional boomtowns and the towns being affected by hydraulic fracturing (Brasier et al., 2011). According to Waples (2012):

Though there may be similarities underground in shale formations in the Southwest and Northeast, shale drillers in Appalachia knew immediately that when it came to complex industrial gas extraction, the mountainous and heavily forested topography of Pennsylvania and West Virginia were not the plains of Texas and Oklahoma. Landowners and localities unfamiliar with shale drilling, environmental worries, access challenges, and state regulatory and legislative hurdles were obstacles perhaps greater than the solid rock between the topsoil and the shale. (p. 234-235).

The difference in geography and culture implies the likelihood of additional impacts to those discussed in western boomtown literature.

The background of a region plays an important role in shaping the severity of impacts from energy development. According to Albrecht (1976), “areas that have experienced little social change in the past, that have been largely isolated from the mainstream of the larger American society, and that are fairly homogenous in terms of cultural, ethnic, and social characteristics of their population are likely to be more severely impacted by growth and change” (p. 5). This description can generally be applied to the Appalachian region, suggesting this region is particularly vulnerable to the impacts of this activity. A study conducted on the development of coal mining in West
Virginia found that this form of industrialization was unique in that it remained within a rural environment (Lewis, 1993). Major population booms associated with coal mining activity created cultural change in the region, with conflicts erupting between those set in the old cultural practices, and those embracing change (Lewis, 1993). In the end, community size and isolation determine the severity of population change impacts, with larger communities being better able to absorb an influx of workers (Jacquet, 2009).

Figure 1. Map of Shale Plays of the Lower 48 States. Source: EIA 2010.
Future Trends

Paradoxically, while the overall population in natural gas boomtowns increases due to the influx of outside workers, a recent trend in declining resident populations has been identified. This has been documented in Noonan, North Dakota, where the permanent population has continually decreased since the start of energy development in the late 2000s, while the population of transitory workers continues to grow (Mayda, 2011). This is contrary to historical boomtowns from coal or oil development, which typically saw a sudden, rapid increase in resident populations that migrated to the town for job opportunities. This change may be due to the fact that recent natural gas development typically involves the use of outside worker populations who have already
been trained by the industry, and are placed into crews on rotating shifts of one to two weeks (Jacquet, 2009). There are therefore few job opportunities for the resident population, as well as a faster turnover rate for the jobs that are available.

Natural gas boomtowns provide a push factor for long-time residents to emigrate, given the variety of economic and social impacts that occur, as well as fears of environmental contamination. Due to the greater population density of the Marcellus Shale region, it is easier for residents to move to a nearby town than it was in remote western boomtowns (Jacquet, 2009). All of this is likely to culminate in an increasing trend of the depopulation of natural gas boomtowns, leaving behind communities for the exploitation of the energy industry.

Conclusion

While some research has been conducted on the environmental and economic impacts of unconventional natural gas development, many aspects of this development are unknown, particularly when looking at long-term impacts. The authors of several articles stress the need to focus on how local residents perceive the threats of extractive industry in their communities (Shriver and Webb, 2009; Brasier et al., 2011; Theodori, 2009). Brasier et al. (2005) found that perceptions of the impacts of hydraulic fracturing varied greatly between case sites, with the major determinants of perception including: previous community characteristics, extractive history of the region, population size, density, and isolation. Brown et al. (2005) claim that pre-conceived notions about energy development may impact the attitude of residents.
Brasier et al. (2011) and Theodori (2009) developed recommendations based on their case studies of unconventional natural gas development, which apply to the areas of public policy in regards to mitigating the impacts of extractive activity to local communities. However, both authors stress that their conclusions were reached in regards to particular locations with a certain level of natural gas development, and thus may vary in different places and community structures. There is therefore a need for studies in more locations in order to analyze the common themes between different regions and types of communities undergoing hydraulic fracturing. In addition, there is a further need to understand the factors that create the varying perspectives that occur between different regions and communities, as well as the factors that cause varying perspectives within communities. Research also should be conducted on how the perceptions of the impacts of hydraulic fracturing change over time as levels of activity change.

The exploitation of natural resources for energy consumption has produced a variety of impacts for the communities located near this industrial activity. Environmental, economic, and social impacts have been identified in regards to the process of hydraulic fracturing for natural gas. Concerns abound over threats to health, quality of life, and community cohesion that may result in communities undergoing this development. A major limit on studies in this area is the fact that hydraulic fracturing is a relatively new process, and therefore no long-term studies have been conducted. This leaves many questions in regards to the lasting consequences of this activity.

This literature review led to the development of the research questions:
• What are residents’ perceptions of the social impacts of unconventional natural gas development, and what factors cause variation in these views?
CHAPTER 3: DATA COLLECTION AND METHODS

Case Study Setup

This study employed the use of qualitative research methods. According to Corbin and Strauss (2008), qualitative analysis is “a process of examining and interpreting data in order to elicit meaning, gain understanding, and develop empirical knowledge” (p. 1). This method of research was selected due to the fact that it “allows researchers to get at the inner experiences of participants, to determine how meanings are formed through and in culture, and to discover rather than test variables” (Corbin and Strauss, 2008, p. 12). In this particular study, the use of qualitative research allows for a greater understanding of subjective processes occurring within the case study location, contributing to the sociological research on resource extraction in rural communities.

A case study was chosen as the best method to investigate the research questions. Yin (2009) describes a case study as “an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 18). For this particular case, the investigation involves the impacts of energy development in a small community. The rural setting influences residents’ perception of experienced impacts, while the impacts are in turn changing the nature of the community, showing the inability to separate phenomenon and context. The case study process involves in-depth data collection with multiple sources, and “reports a case description and case-based themes” (Creswell, 2007, p. 74). This case study was bounded by the county of Wetzel in West Virginia, and focused on the issue of unconventional natural gas development to long-
time residents of this community. A case study approach is appropriate in this situation in that there is a clearly identifiable case with the set boundary of the county, and that the intent of this study is to provide in-depth understanding of the impacts of natural gas development within this community.

Following common case study procedures, the case was specifically identified, with the research questions being developed through a review of current literature on the topic. The theory guiding the development of this case study includes previous studies on the impacts of unconventional natural gas development to rural communities, particularly as regards residents’ perceptions of the impacts and overall changes to community functioning. The methodology in the most relevant literature included in-depth case studies that employed the use of semi-structured interviews (Brasier et al., 2011; Theodori, 2009). These studies focused on either New York (prior to the hydraulic fracturing ban) or Pennsylvania. Brasier et al. (2011) used purposeful sampling in order to find suitable counties to include in the qualitative case study, followed by random and snowball sampling to select interviewees. Theodori (2009) employed both qualitative and quantitative research, with the use of both a survey and interviews in two counties. These counties were selected based upon the fact that one had a history of natural gas development, while the other was being newly developed. Based upon these previously used methodologies and the scope of this particular study, it was decided that semi-structured interviews would be the main source of data collection, to be strengthened through the use of field observations, photography, and demographic data.
With the research questions, main methodology, and the best study site being established, purposeful sampling was then conducted in order to find interviewees (snowball sampling also was employed in order to help find enough interviewees for this study). Data collection was carried out with the use of multiple sources, which included in-depth, semi-structured interviews, personal field observations and photography, and the collection of demographic and employment data for the community through the U.S. Census Bureau and U.S. Bureau of Labor Statistics.

According to Lindlof and Taylor (2011), “triangulation involves the comparison of two or more forms of evidence with respect to an object of research interest” (p. 274). The use of triangulation adds validation to the data when the same conclusions are reached through the different sources or methods. This case study incorporated the use of multiple data sources including interviews, field observations, and demographic data. The conclusions of this study were strengthened due to the similar patterns emerging through these different sources.

As this case study involved human subjects, Institutional Review Board (IRB) approval was obtained (see Appendix A), and all procedures followed the IRB guidelines. Interviewees were kept anonymous due to the sensitivity of the subject area, and steps were taken in order to guarantee protection of their identities. Interviewees were informed of this protocol.

The research occurred over the following phases between December of 2011 and April of 2013: 1) Review of the current literature and development of research questions based on research gaps in the literature; 2) Seeking out appropriate study site and
conducting preliminary research on selected study site; 3) Networking in order to establish interviewee contacts; 4) Creation of research proposal and approved defense of proposal; 5) Developing interview questions; 6) Attainment of IRB approval; 7) Data collection over two weeks which included interviews, field observations, and photography; 8) Analysis of data which included transcription, categorization, and coding; 9) Writing the research findings as a thesis; 10) Defense of thesis and approval of final edits.

Study Site

The case study was conducted in the rural Appalachian region of Wetzel County, West Virginia, on the impacts of natural gas development as perceived by the residents. Wetzel County is located in the north-central portion of West Virginia, and borders both Ohio and Pennsylvania (see Figure 3). The largest town in this county is New Martinsville, which lies on the banks of the Ohio River. The case study focused on the rural community surrounding the town of New Martinsville. This location was selected due to the fact it has already experienced hydraulic fracturing for five years; has had drilling occur both on leased land and on land where the mineral rights are severed from the surface rights; and due to its proximity to Ohio University. In addition, no major qualitative case studies had been conducted on unconventional natural gas development in West Virginia at the start of this case study.

According to the West Virginia Geological and Economic Survey (2012), Wetzel County was the top Marcellus Shale gas producer in West Virginia in 2010 (see Figure 4). In 2011, Wetzel County dropped to second place with 33,000,000 Mcf of gas
produced. As of September 2012, Wetzel County had 153 permitted Marcellus wells, and three compressor stations (see Figure 5). The largest natural gas field in Wetzel County is Victory Field, which extends into Marshall County. Chesapeake Energy and Stone Energy Corporation are the largest natural gas companies drilling in the county (WVGES, 2012).
Figure 3. Regional map with Wetzel County, W.V. highlighted.
Figure 4. Map of West Virginia Marcellus shale gas development. Permitted wells are shown in yellow.
Figure 5. Map of Wetzel County, W.V. Marcellus shale gas development.

Permitted wells are shown in yellow.
Demographics

Based on the 2010 U.S. Census, Wetzel County had a median household income of $36,636, with 17.5 percent of residents making an income below the poverty line. In 2011, the total population was 16,351. The population age distribution includes 75.7 percent of the population at 21 years and over, and 23.8 percent of the population at 62 years and over. The racial distribution shows 98.7 percent of the population is white. The percentage of the population that has graduated high school is 82.5 percent.

Based on the Bureau of Labor Statistics, Wetzel County had an annual unemployment rate of 7.0 percent in 2008 when natural gas development began, steadily rose until it peaked at 12.6 percent in 2010, and as of 2012 was at 10.8 percent (See Figure 6). West Virginia unemployment rates were at 5.3 percent in 2008, 8.4 percent in 2010, and 7.4 percent as of 2012. National unemployment rates were at 5.8 percent in 2008, 9.6 percent in 2010, and 8.1 percent as of 2012.

The U.S. Census Bureau shows that between 2000 and 2010, the population of Wetzel County had a -6.27 percent population change, as compared with 2.47 percent for the state of West Virginia. The population of Wetzel County had a -1.4 percent population change between 2010 and 2011, as compared to 0.1 percent for the state of West Virginia. This suggests a trend of declining population in Wetzel County, which differs from population trends for the overall state of West Virginia.

The Appalachian Regional Commission (2013) categorizes Wetzel County as “at risk of becoming economically distressed” which indicates it is “rank[ed] between the worst 10 percent and 25 percent of the nation’s counties” (para. 4) (see Figure 7).
Figure 6: Unemployment Rate in Wetzel County, WV 1990-2013. Source: FRED 2013.
Interviewee Recruitment

A total of twelve interviewees were selected in order to provide a variety of backgrounds and opinions on the impacts of natural gas development within their community (see Table 1). Mixed methodologies were employed in order to find suitable participants (Yin, 2009). Purposeful sampling (“select[ing] those participants who will
provide the richest information”) was used to find initial interviewee contacts. Snowball sampling (“find[ing] subjects of interest from those who are most likely to be able to identify them”) was then employed in order to find further interviewee contacts with the characteristics appropriate to the research questions (Best and Kahn, 2006, p. 19).

Purposeful sampling was conducted to include only long-time residents of twenty-five years or more, in order to gain perspective on major changes within the community. Both those who do not own their mineral rights and those who willingly leased their rights were purposely included in order to explore the mineral rights ownership dynamic.

In addition, small business owners were purposely included to provide further perspective on economic benefits. While not intentional, all interviewees are homeowners. Five interviewees are mineral rights owners, one is not sure, and one only owns some of the mineral rights. Five interviewees have signed natural gas leases, with three of these leases for non-surface rights (with a wellpad on a neighboring property). Four interviewees have a well pad on their own property. Two interviewees have a well pad on their property, without having signed a gas lease as they do not own their mineral rights. Nine interviewees currently have a well pad on a neighboring property. Three interviewees are small business owners.
Table 1

Interviewee Background

<table>
<thead>
<tr>
<th>Interviewee</th>
<th>Length of Residence</th>
<th>Homeowner</th>
<th>Mineral Rights Owner</th>
<th>Signed Gas Lease</th>
<th>Well Pad on Property</th>
<th>Well Pad on Neighboring Property</th>
<th>Business Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35 years</td>
<td>Yes</td>
<td>Not Sure</td>
<td>No</td>
<td>No</td>
<td>Soon to be built</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>77 years</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>78 years</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>25 years</td>
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<td>Yes</td>
<td>No</td>
<td>No</td>
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<td>No</td>
</tr>
<tr>
<td>5</td>
<td>42 years</td>
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<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>39 years</td>
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<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>35 years</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>35 years</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>9</td>
<td>41 years</td>
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<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>38 years</td>
<td>Yes</td>
<td>Some (non-surface lease)</td>
<td>Yes (non-surface lease)</td>
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<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>11</td>
<td>30 years</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (non-surface lease)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>12</td>
<td>30 years</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (non-surface lease)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Instrumentation

Basic interview questions were prepared regarding changes to the community since the upsurge of natural gas development (see Appendix B). These questions included background information, as well as positive and negative impacts experienced
from the natural gas development. The questions were designed in order to allow interviewees to expand upon topic areas they wished to discuss, and also to bring up any topics not included in the questions that they felt were relevant. Questions began more generally, and then narrowed into specifics. Questions also evolved following the initial interview, in order to better fit with residents’ terminology as well as include mentioned topics that the researcher had not initially considered. The method of developing these questions was appropriate given the use of case study research in the form of semi-structured interviews.

Data Collection

The researcher spent two weeks in Wetzel County, West Virginia, in August of 2012 in order to conduct interviews and collect field observations. Field observations involved travelling throughout the county, including the town of New Martinsville, small businesses, various well pad locations, residents’ homes, and the Lewis Wetzel Wildlife Management Area. Extensive journaling and photographic records were taken. Eight in-depth interviews were conducted with a total of twelve interviewees in the rural community surrounding the town of New Martinsville. Interviews were held at the personal residences of interviewees, or at the location of businesses for the small business owners interviewed. The use of these locations was intentional in order to help put the interviewees at ease due to privacy and being in a familiar location. In addition, this added to field observations and validity of the interviews as aspects of these locations were often mentioned in the interviews. Interviewees were informed that they would be
kept anonymous, which allowed more interviewees to be willing to participate.

Interviews were held until data saturation had occurred, and no new themes were
discovered. Interviews were informal, “guided conversations”, allowing for interviewees
to expand into topics beyond the prepared questions (Yin, 2009, p.106). Interviews
ranged from 13 to 42 minutes, averaging 24 minutes in length. Interviews were recorded
with a handheld digital recorder, and later transcribed with Express Scribe software.
Transcriptions were careful to include nuances within speech and background noises.

Analysis

Data analysis continued to follow standard case study procedures, with the use of
holistic analysis that looked at the entire case, which was followed by embedded analysis
in order to look at specific aspects of the case (ie. residents’ perceptions of the impacts of
natural gas development and why these perceptions varied). Major themes were
identified through coding and categorization, with in-depth analysis allowing for a greater
understanding of the complexity of this case study and providing context. Data analysis
was performed through the multi-step process of data management (through transcription
and the sorting of field observations), data reduction (selecting data as codes then
condensing these codes), and conceptual development (through the development of main
themes that provided focus to the topic) (Lindlof and Taylor, 2011). The final step was
representing the data through tables and narrative (Creswell, 2007).

While reading through the transcripts and field notes, asides and commentaries
were written, as well as in-process memos (Lindlof and Taylor, 2011). This highlighted
certain information, allowing for reflection on the data and the initial development of themes. A full summary of the field notes were written immediately following the end of the two weeks in Wetzel County.

The development of categories and codes is described by Lindlof and Taylor (2011) as the “systematic start of analysis” (p. 246). Categories are defined as “an array of general phenomena” (p. 246). Codes serve as links between the data and created categories, and “characterize individual elements that make up a category” (Lindlof and Taylor, 2011, p. 247-248). They also mark the text in order to allow easy retrieval of relevant data. Both open and in vivo coding was used. Open coding occurs initially, and allows the research unrestricted coding of the data in order to create subcategories within categories. This is followed by in vivo coding, which is worded in the exact terms used by the interviewees themselves. According to Creswell (2007), this includes looking for codes that represent information the researcher expected to find, represent surprising information, and represent conceptually interesting information. Again, these codes are constantly compared to each other. Thematic memos were created within the text in order to grasp the thematic meanings of the discovered categories. Selective coding is used to write a storyline which connects the categories (Creswell, 2007).

Interviews were coded using the Computer-Assisted Qualitative Data Analysis Software (CAQDAS) NVivo, which is a “code-based theory building tool” (Lindlof and Taylor, 2011, p.256). The use of this software assisted in determining emergent themes for further analysis by helping to organize the data and tracking created codes. Codes are worded based upon interviewees’ own word choice to refer to impacts. After codes were
identified, they were then classified into major themes through the discovery of patterns in the data, with sub-themes included in these over-arching themes (see Tables 2 and 3). This dimensionalization of the data involved analyzing each topic and teasing out the main components, until theoretical saturation was reached. “High-inference categories” were created through the careful examination of the data, and finding closely related units of text that implied a new category (Lindlof and Taylor, 2011, p. 246-248). The frequency of codes was recorded through NVivo software. The main themes were chosen based on length of discussion, relevance to topic, and the number of times they were mentioned in interviews (see Table 2).

Table 2

Main Themes from Interviews*

<table>
<thead>
<tr>
<th>Main Themes</th>
<th>References</th>
<th>Sources**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased Conflict</td>
<td>39</td>
<td>8</td>
</tr>
<tr>
<td>Environmental Impacts</td>
<td>47</td>
<td>8</td>
</tr>
<tr>
<td>Economic Impacts</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Traffic and Infrastructure Changes</td>
<td>27</td>
<td>8</td>
</tr>
<tr>
<td>Gas Development on Property</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td>Rural Lifestyle</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>Addressing Problems with Gas Industry</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Powerlessness</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Inequalities</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Long-term Concerns</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: This list includes themes that were discussed in-depth during interviews, grouped together into over-arching themes, and listed in order of most-discussed to least-discussed.

Note: Sources describe the number of interviews where the theme was discussed in-depth.
Table 3

*Sub-themes from Interviews*

<table>
<thead>
<tr>
<th>Theme</th>
<th>References</th>
<th>Sources**</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Economic Changes</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Conflict with Gas Workers</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>Conflict in Community</td>
<td>14</td>
<td>7</td>
</tr>
<tr>
<td>Air Pollution</td>
<td>13</td>
<td>8</td>
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Table 3 (continued)

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Note: This list includes themes that were discussed in-depth during interviews, listed in order of most-discussed to least-discussed.
Note: Sources describe the number of interviews where the theme was discussed in-depth.

While certain topics were targeted for analysis prior to the data collection occurring, the analysis also evolved during data collection. Following the procedure outlined by Creswell (2007), relations were noted between main categories, and related categories were tied into the literature reviewed prior to this study in order to contextualize the data. This involved integration in order to make connections between the categories and generate theory based upon the reoccurring metaphors, fears, and concerns, and the intensity with which topics were discussed. Analysis included which interviewee discussed which themes (or avoided discussing certain themes), resulting in the discovery of a pattern.

Themes explored in this case study include looking at the exploitative nature of energy extraction within the Appalachian region, the burden this places on the rural communities where this activity occurs, and the inequalities among the experienced impacts. A focus was given to the loss of cohesiveness and social capital within the community, with tensions arising between mineral rights holders and non-mineral rights holders, as well as between the urban center and the surrounding rural region (Bell, 2009;
The theme of powerlessness was explored, with a political structure involving mineral rights ownership and outside interests. Demographic data added to the analysis, particularly as regards the socioeconomic status of residents.

Creswell (2007) describes the need to create a point of view for the readers, which in this study is framed within the varying perceptions of residents and typologies who expressed these viewpoints. A final interpretive phase was carried out for data analysis which involved reporting the main meaning of the case, which Creswell (2007) describes as the “lessons learned”. This also involved developing naturalistic generalizations of this case study to similar communities experiencing energy development (Creswell, 2007).

Validity

While conventional validity tests were not applied to the instrument and method, the design and method helped to achieve a certain level of validity. The validity of interview responses was built up through the research collection process. The questions were designed carefully to avoid being misleading, and also remained open-ended to allow the interviewees’ own viewpoints to be strongly developed. In addition, the use of personal field observations, photographs, data on community demographics, and employment statistics allowed for verification of statements made in the interviews. Furthermore, the following of established qualitative research methodologies for case
study research as a multi-step process with constant comparison of data further helps to achieve validity in this study.

Limitations

Major limitations to this study include the sample size, response rate, and the length of the study. The number of interviews conducted was limited both by time constraints and whether residents both responded to initial contact and agreed to conduct interviews. In addition, the data collection occurred over two consecutive weeks, providing a snapshot of a particular time. Research conducted at the initial phases of natural gas development or post-development (during the “bust” phase) is likely to present a different snapshot. Research conducted over multiple years of natural gas development would provide a clearer picture. The researcher attempted to overcome this limitation as best as possible by establishing a history of this county and asking residents about how the community has changed over time. Collection of background information and the analysis was also limited by time constraints.

Common methodological issues that are likely relevant to the data analysis include inference (“persuasiveness of interpretation”), generalizability to larger society, identity (“relation to various social groups”), and activity type (“relation in other contexts”) (Bauer and Gaskell, 2000, p. 201-202). Interpretation is always influenced by the researcher’s own bias, which in this case includes a background in the field of environmental studies. There are questions as to how this data applies outside of Wetzel County, outside of Appalachia, and to other forms of energy development/resource
extraction. Within Wetzel County, only long-time residents were included for this study, which does not necessarily represent the opinions of all residents.
CHAPTER 4: DATA ANALYSIS AND DISCUSSION

The purpose of this study is to construct the story of unconventional natural gas development in the rural Appalachian community of Wetzel County, West Virginia, through the impacts experienced by residents. Data collection occurred primarily through interviews with residents and field observations, with analysis being heavily focused on the findings of the interviews.

Interviews conducted with residents of Wetzel County revealed numerous impacts associated with unconventional natural gas development, with perceptions as to these impacts varying amongst residents. Major impacts include interconnected environmental, economic, and social effects. The most common topics discussed in interviews include economic changes such as new jobs and increased local business; increased conflict between community members, as well as with natural gas industry workers; pollution including air, water, noise, and light pollution; increased traffic and changes to infrastructure; fears over health impacts; and an overall loss of rural lifestyle as the community is industrialized. Interview themes delved into a variety of topics that fit within a broader context of resource extraction within the Appalachian region. This includes a power structure set up with mineral rights ownership and outside interests; a sense of powerlessness and resignation among residents; the difficulty of addressing problems that arise from natural gas development; and the unequal distribution of problems and benefits resulting from this development.
Field Observations

Despite extensive background research, I did not know quite what to expect when I began my interviews in Wetzel County. I am an outsider to West Virginia, having been raised in Buffalo, New York, and a resident of Athens, Ohio, for only a year. Yet, despite my foreign dialect, I found everyone I spoke with friendly. Certainly there were some hoops to jump through to win people’s trust, particularly in regards to the older men I interviewed. What did I know of this community, and what they have been living with? What exactly was I looking for, and how would I represent them? Of particular suspicion was my association with the environmental studies program, and what sort of slant I would portray. The older women I talked to were exceedingly warm, and clearly enjoyed chatting. Whenever I interviewed a married couple, I would have the two constantly interrupting each other. I also found the men to often be considered a better authority on the subject in the eyes of their wives – although the wives certainly did hold their own opinions. Some of my interviews were lighthearted, with frequent laughter. Others delved into serious issues, with one of my interviewees even tearing up while discussing health impacts to her grandchildren. Some of my interviewees were quiet and intense, with a gaze that cut into you. Others were boisterous and smiled often. All of them expressed a love for the country lifestyle, and had a sense of resignation toward the situation regarding natural gas development in their community.
New Martinsville is nestled in the Ohio River valley, surrounded by hills. The rural community living around this town is close knit, the sort of place where everyone knows everyone’s name. I picked up on the tension between neighbors regarding the natural gas development, although comments were often made in a joking matter. A dividing line appears to have been drawn between those who own their mineral rights and are benefitting financially from a natural gas lease, and those who do not. Further, a world of difference seemed to lie between the town folk and country dwellers. In town only the benefits could be seen (with the exception of traffic): hotels full, restaurants and gas stations busy, struggling small businesses able to remain open. To me the town still seemed small and rather dead once away from the main road and gas stations, which made me wonder, what would this town be like without this boost in economic activity? Outside of town, however, the economic benefits do not extend, unless one is a fortunate mineral rights owner with a productive natural gas lease. Otherwise only the noise, the dust, and fears of contamination abound. I heard repeatedly that the peace and quiet was missed. Throughout my interviews, one truck after another would pass by. I could barely hear the interviewee on one of my recordings due to the constant background noise of a working gas rig. While exploring the Lewis Wetzel Wildlife Management Area, I was stunned by the extent of gas development. The fact that I saw no one here except natural gas industry workers, with only dust and wilting plants on the side of the road, made me wonder why it was still designated “wildlife management”. Energy
management would certainly be more fitting. I had to pause at a sign stating “wildlife viewing area” beside an area filled with natural gas tanks, not only because the sign appeared to have been bent due to the passing of a large truck (see Appendix D).

The drive to the natural gas well pads involved winding, narrow roads, oftentimes along the edges of hills with a shear drop to my side. While rounding one of these, a gas company truck flew down the road well over the center line, and for a moment I thought I saw the end…A resident who drove me to some of the more remote sites seemed unfazed by nearly identical occurrences, and whipped around the roads in a manner I never would have attempted. He represented a characteristic that I also recognized in the other residents I interviewed: resolute, and with an intense love for the land, finding value in it as a home and a community that cannot be measured monetarily (personal observation, August 25, 2012).

Data Analysis

The impacts identified in this study include interrelated economic, environmental, and social impacts. Social impacts within this study broadly include impacts to residents’ lifestyle and community functioning. The impacts discussed in the interviews reveal similarities to previous literature, including both older western boomtown research, and more recent research on unconventional natural gas development. When asked about changes within their community when natural gas development began, interviewees had a
wide variety of impacts they wished to discuss. At times answers were contradictory between different interviewees, suggesting both differences in perceptions and different distributions of positive and negative impacts. The initial interview question has been included where necessary to understand the response. Interview responses were separated into themes; given the interconnectedness of varying impacts, certain responses could be placed into multiple categories.

Loss of Rural Lifestyle

The majority of residents discussed a wide variety of changes that had occurred within the community without being prompted by the researcher. However, residents’ descriptions ranged from inconveniences such as increased traffic to a nightmare scenario. Residents who had signed a natural gas lease and were drawing royalties did name negative impacts, although these tended to be described more as inconveniences than a complete change in lifestyle.

When asked about the community of Wetzel County, one interviewee stated:

Interviewee #9: It's a lot easier to tell you what I used to like about it. Was the peace and quiet. That went along with country living.

It was clear that residents valued the rural lifestyle that had been found in Wetzel County. However, the majority of residents described this lifestyle as a thing of the past, as the region had been industrialized through natural gas development. Residents who did not mention this loss of lifestyle included four interviewees who had signed a natural gas lease and were drawing royalties.

When asked generally about changes to the community when natural gas development began, the following was revealed:
Interviewee #9: Everything changes [...] Road damages, the lack of appreciation for water and the environment. The safety of the roadways, the freshness of the air. That comes along with country living. Noise. Lots of noise, constantly, from the well development and also the pressure stations running. Lighting pollution from the pressure stations. Depreciation of property value. People's attitude.

One interviewee compared the changes to those experienced with coal mining:

Interviewee #4: This old country use to be like John Denver's country, but now it's coal country—not coal-gas country haul roads just like the coal country haul roads.

This rapid industrialization of a small rural community is captured in the following statement:

Interviewee #7: When you move out here you move out here because of the quiet, you know, the solitude. I ain't getting that now. Forget that. It's taken what we know as country living, and it's turned it completely upside down. They ruin your way of life.

Due to the health problems her family has been experiencing, which she believed was linked to the hydraulic fracturing activity after discovering their well water to be contaminated (see p. 73 and p. 75), one resident succinctly described her whole world being turned upside down:

Interviewee #6: It's like living in hell.

Economic Changes

The interview questions then delved into specific impacts. General economic changes were discussed in the interviews more than any other sub-theme (see Table 3). Opinions varied as to economic benefits and disadvantages, with lines drawn between those who are personally profiting through a gas lease or small business owners seeing an increase in business, and those who are dealing with new economic burdens due to the
activity. Economic changes mirror early boomtown literature (Gilmore, 1976; Kassover and McKeown, 1981; Merrifield, 1984), with the exception that few new jobs were created for residents given the use of outside drilling and construction crews.

**Economic Benefits**

In terms of job creation, certain interviewees felt there had been a substantial number of new jobs created through the natural gas development. A short-term focus included discussions of construction and truck jobs, as well as increased local business, which represents the boom part of the boom-and-bust cycle. Residents stated:

*Interviewee #2:* There's been jobs, lots of jobs created.

*Interviewee #10:* Certainly there are more people hired than there were. The unemployment rates don't really show that for Wetzel County, but, you know, anybody around who is of worth, you know, has been able to get hired on I think.

*Interviewee #11:* I know two local people, and I won't mention their names, that are employed with the gas, with Chesapeake. I'm sure there's more, and I know Littman Excavating has hired a lot more people. I don't know exact figures, but you can see their trucks all over the place. And they use local people too.

None of the residents seemed clear about how many new jobs and how many local jobs had been created. Furthermore, they attempted to justify the low unemployment in the county through claims of high drug use and laziness among the younger population.

Other residents present a long-term focus, which includes the dearth of long-term jobs associated with the natural gas development, as well as local business dissipating over time as the natural gas industry workers move on to another town, representing the bust portion of the cycle. One resident stated:
Interviewee #9: I try to look at this, as far as job creation, I try to look at the long-term benefits. What I've witnessed over the last five years, being involved with this type of development, there's tons of short-term, as far as long term it's very minimum.

Since the short-term benefits exceed the long-term benefits of this form of development, the level of benefit described depends on whether the resident has a short-term or long-term perspective. It is apparent that the natural gas industry has a slant toward a short-term focus. Interviewees also focused on the high unemployment still prevalent in Wetzel County:

Interviewee #9: When Wetzel County alone was at its peak of drilling, with not just Chesapeake's operation but Stone Energy and other drilling companies in the area, Wetzel County had the highest unemployment rate ever [...] But that's one of their trump cards that they play all the time, the gas development: jobs, jobs, jobs. Well you can't argue with it. It does bring them, but they're very short-term. Once they operation's up and running, a twelve compressor station, two people can run it.

The following resident is suggesting that the drilling is past its peak in Wetzel County, and the community is now entering the bust portion of the boom-and-bust cycle:

Interviewee #10: The whole boom and bust cycle of things, which, I mean, we're already seeing it here, where it's leveled off here. And, the gas guys are moving more into the Utica Shale. [truck drives by] The energy business, you know, it's just the way it goes, with boom and bust, and they change their focus and move on.

This resident presents the energy development as rapid, dramatically changing the community, and then just as quickly disappearing.

All of the interviewees mentioned that outside working crews held jobs, however ranged in the emphasis placed on the number of local jobs created. Interviewees who were personally benefitting from the activity through natural gas leases or increased local
business emphasized the local jobs created, such as truck drivers, while other interviewees focused on the low number of long-term jobs created and the high unemployment rate that still existed in Wetzel County (the unemployment rate increased in Wetzel County after natural gas development began, which corresponded with the national economic recession; see p. 59-60 for unemployment statistics). Interestingly, three interviewees stated that they believed few jobs were given to local residents due to the high number of young men addicted to drugs within Wetzel County (see Appendix C for quotations). However, no data could be found backing up these statements.

Interviewees also discussed the economic benefits to small businesses in the area, particularly within the town of New Martinsville:

Interviewee #4: The local business, your eateries and hotels and stuff like that, are doing okay. I think the local town people are doing alright.

This emphasizes the separation between the town and surrounding rural areas, with New Martinsville experiencing the majority of the financial benefits. An obvious benefit from the natural gas development was to the local motels, as the workers fill them during their rotating one or two week shifts. This was evident by the fact that all the motels had no vacancy during the course of this case study.

One resident stated:

Interviewee #11: Let's face it, New Martinsville's a nice little quaint town, but the motels were hurting for money because who's gonna come here for a vacation?

All interviewed residents recognized that the town of New Martinsville was benefitting the most from the natural gas development. Residents varied in stating how much this benefit extended into the surrounding rural community. This rural versus town
dynamic suggests an unequal distribution of the positive and negative impacts of natural
gas development within Wetzel County; this dynamic was also observed in the study by
Brasier et al. (2011).

Small business owners described the benefits they personally have experienced
due to increased patronage from the natural gas industry workers living in the area. The
following resident lived well outside of the town of New Martinsville, and represents a
small business benefitting within the surrounding rural community:

Interviewee #10: We see more traffic. In the beginning, we didn't, but
now we do see more traffic that is directly related to the gas drillers. It's
nothing phenomenal. But it's definitely an improvement [...] You have
some RV parks around, some of the wives come around, you know, they
want something to do on the weekends, they come out here.

Another small business owner who described benefitting from the natural gas
development lived closer to the town:

Interviewee #2: Restaurants, and motels, and our gun shop has benefitted a
lot because these oil and gas men are outdoor people, they come and buy
our guns. We never expected to benefit this much in this business. But,
it's so busy now we can't hardly keep up with it. So it's been nothing but
positive for us, in every way.

This resident was also drawing royalties from a natural gas lease, thus finding
multiple benefits from the natural gas development.

Two interviewees discussed possible overall economic benefits not only to Wetzel
County, but to the state of West Virginia through an increased tax base, which is also
discussed in the reviewed literature (Brown et al., 2005; Jacquet, 2009; Brasier et al.,
2011). These interviewees had signed a natural gas lease and were drawing royalties.

Interviewee #11: All the fire plants and coalmines are in either Marshall
or Ohio counties, so the tax base is basically the individual taxpayers [in
Wetzel county]. Which you pay on the money you receive on your royalties, between eight and ten percent goes to the state off the top. [...] So it's kind of helped.
Interviewee #12: And the county taxes, those are going up.
Interviewee #11: And West Virginia's one of the few states that isn't in the black yet. I'm not saying it's because of the drilling, but this will help naturally.

The taxes on royalties are therefore helping bring revenue to Wetzel County, which has few other ways of generating revenue due to the absence of the coal industry found in neighboring counties.

Economic Burdens

Certain rural residents discussed negative economic impacts they had personally experienced due to the natural gas development, often as a result of damage to personal property:

EM: Did you notice any economic benefits of the natural gas development?
Interviewee #7: Not to me I didn't. When they had water out here on the gravel part of the road-I got that stopped-I would drag it around under my truck, and it cost you money. We were dealing with the dust, then they created a bigger problem by trying to keep the dust down. The limestone turns to a cement [...] it tears your vehicle up underneath. You're dragging this stuff around. You have to go get it cleaned, and that's money out of my pocket. It's not out of theirs; it's out of mine, because of what they're doing.

Two other residents also discussed problems with this cement-like limestone damaging their vehicles. Other property damage problems discussed include large trucks tearing up driveways, and harm to farm animals including the death of a goat after industry workers left a gate open (see Appendix C for quotations).

Major changes to rental prices and housing/land value were described by residents as an impact of the rapid natural gas development. Increased rental prices within the
town of New Martinsville were due to the influx of natural gas workers in the community. This same impact was discussed in energy boomtown literature, although this case did not seem as extreme as certain cases in the literature (Brown et al., 2005; Jacquet, 2009; Goldenberg et al., 2011; Brasier et al., 2011; Mayda, 2011). This is an example of how nuanced the impacts of energy development can be, as the increased rent places a burden on local renters, while simultaneously benefitting local landlords. One resident stated:

Interviewee #2: It's not fair. But some people have raised the rent a lot just because they could.

In contrast, decreased housing and land value was occurring in the surrounding rural community on properties where natural gas development was taking place due to such quality of life impacts as traffic, noise, and light pollution, and also likely due to concerns over contamination:

Interviewee #5: I think it sure costs the landowners a lot of money because our property was 3,000 dollars an acre, and it's dropped down now to 7 to 800 dollars an acre. Of course, the taxes hasn't dropped any. In fact, mine's almost doubled.

Residents worried that if they needed to move away, they would not be able to sell their property, and would in a sense be trapped:

Interviewee #4: I could see people coming up here and saying I don't want this damn farm with all this traffic coming up it.

Interviewee #7: Who's going to buy a house with all this? A one lane road with traffic like this. I mean I don't ever plan on leaving, you know, but if we had to, then we can't sell it.

One resident discussed the increased economic burden experienced by residents in the rural community:
Interviewee #1: My wife sent to Chesapeake a list of expenses, out of pocket expenses, my wife had occurred because of Chesapeake, amounting to 2,000 dollars a year. Is that an unjust taking? In a legal sense? […] It's about 2,000 dollars a year that we were contributing to Chesapeake's business model. If for them to succeed in business, this resident had to pay 2,000 dollars extra a year and in lost time for the extra travel, and for vehicle wear and tear. Now is that being unjustly treated? Some people would say absolutely because they never reimburse people's expenses so is that unjust? Boy, it feels unjust. It's just the way large corporations can push their way into a rural community and not really take into consideration the costs of all the residents out there.

This statement also reveals a sense of unfair treatment among residents living in the middle of the natural gas development, and therefore receiving the brunt of the negative impacts.

Traffic

Traffic was the next most frequently discussed impact, representing both a quality of life issue as well as a safety concern. The passage of large trucks in order to haul in the equipment needed to construct the drill rigs, transport hydraulic fracturing fluids, and remove waste water overwhelmed the narrow, windy country roads. At times the gas companies had widened and paved roads in order to improve this situation. Road safety and the inconvenience of the traffic were major concerns among residents. Throughout the interviews, large industry trucks could be seen passing by the properties or businesses of residents. Residents stated:

Interviewee #4: When they did fracking, all them big sand trucks would come in through here, night and day right up past my farm.

Interviewee #8: There's hardly a day when you go into town you don't see somebody from the gas company. Night or day.
These quotations suggest a psychological toll on residents, due to not having any reprieve from the noise as their formerly peaceful countryside becomes industrialized. There is the additional toll of fear for safety due to the increased traffic accidents in the area. Residents claimed:

Interviewee #7: Traveling like a bat out of hades, the traffic.
Interviewee #8: And they don't move over for you. They're used to the cities where they don't have to move over. So everybody that lives here is just afraid coming up the road. You're the one that stops and moves over, not them.

Interviewee #9: Traffic in my area is probably cut eighty percent now, because we only have one drilling rig down there. But when they were drilling and fracking, having six, seven rigs standing in the area, it was a nightmare twenty-four seven. Safety on the roadways. It was very high, the death rates.

One interviewee framed the traffic issue into a positive connotation, given that it represented increased business for the town of New Martinsville, showing again the importance of point of view:

Interviewee #10: You can just look at the traffic in New Martinsville, which people bitch about now. [Laughs] But, you know, that's a result of gas guys, lots and lots of gas guys in New Martinsville.

*Infrastructure Changes*

Certain residents discussed infrastructure damage, usually pertaining to the heavy truck traffic, which is concurrent with previous studies (Brasier et al., 2011; Jacquet, 2009; Theodori, 2009). These residents were not personally benefitting monetarily from the natural gas development. One resident stated:

Interviewee #1: The largest [impact] has been infrastructure damage, the cost of which we don't at all have a handle on. The state hasn't come up with any way to attempt to recoup all the cost. Is the tax the state has on these industries proportional such that the counties where this damage is
occurring, with roads that were not designed for those trucks? Do we have the money to keep up with it? I don’t know.

This is a significant question for communities to ask, whether the revenue from this development outweighs the damage costs.

More frequently, residents mentioned infrastructure improvements that had occurred due to the natural gas industry. All of the residents personally benefitting monetarily from the natural gas development discussed this, along with some residents who were not monetarily benefiting.

Interviewee #2: We have a better road now than we had before they started. They maintained the roads all winter [...] instead of the state doing it.

Interviewee #10: The roads have been narrow, the gas guys have made some of the roads wider. Some roads have actually been improved. If you drove down the road where I live, our road is actually better than it used to be. Up to the well pad. [...] So there are some cases where roads have gotten better. And considerably better.

Interviewee #12: We had two worn out buildings they tore down out for us. They graveled our driveway twice for us-

Interviewee #11: And put a culvert in.

Infrastructure improvements in these regards are rarely mentioned in previous studies, which suggest that the natural gas industry has begun taking mitigation measures in order to handle the infrastructure damage created by heavy truck traffic (Brasier et al., 2011; Theodori, 2009).

Noise

Noise was frequently brought up as a major impact for residents with a working drill rig close to their property. One interview conducted in a resident’s yard had continuous background noise throughout the interview, making the recording inaudible in
parts. The increased traffic also served as a contributor of noise in what had once been quiet back roads. The passing of large trucks is frequently heard in interview tapes where interviews were conducted outdoors. At times, interviews had to be paused until the noise passed. One resident stated:

Interviewee #5: It was nice and quiet out here, you didn't have a whole bunch of people running in and out all the time. And now, I bet there's not an hour that goes by hardly that there's somebody running in and outta here. They come out here all hours of night and day, and from the gate there down to this next house. They'll use their jake brakes and stuff.

As with the previous discussion of traffic, this constitutes a quality of life issue with residents having no reprieve from the noise of drilling rigs and the passage of trucks.

This was also observed in the research of Jacquet (2009).

*Environmental Impacts*

Specific environmental impacts were included among the interview questions. Discussions of environmental impacts closely aligned with known impacts from previous studies (USEPA, 2012c; Earth Works, 2005; GAO, 2012a; GAO, 2012b). The environmental impact most frequently discussed included air pollution.

*Air Pollution*

Air pollution could be viewed as both a quality of life issue and a potentially serious health threat. Problems ranged from road dust, diesel fumes, and chemical odors. Residents stated:

Interviewee #1: Obviously, air quality is a problem. And is one of the ones I've heard other people complain about also. When you have all these diesel trucks, you're adding lots of fumes to the air. This happens at every frack site: silica dust, happens daily, hourly. From the time you start pushing dirt, you're burning diesel fumes. [...] We've had neighbors complain about all the diesel fumes in front of their house. This is a
significant increase and if it's a significant health issue, we don't know. It's that type of air pollution that is difficult to track your exposure to.

Interviewee #6: The rain here is red. That cooler we put next to the house got red on it. This isn't the only place I've witnessed it. After deposits in it dries out, I was told it's a red iron oxide color. [...] It's the damnest thing I've ever seen. Hard to really pin on why or where it comes from, but it never used to be an issue, before they was here.

Interviewee #8: [...] When they were forcing the chemicals down into the ground, we could smell it.

Interviewee #4: Putting up with the dust, it's awful. It used to be blacktop down here but they cut it out and replaced it with limestone. Limestone creates silica dust which will kill you.

Even without conclusive linkages to health problems, the existence of chemical smells, unidentifiable emissions, and silica dust created fear amongst residents, taking a psychological toll. Furthermore, residents had to make lifestyle changes such as keeping windows closed and cleaning more frequently.

Water Pollution

Water pollution was less frequently brought up, although it was still clearly a major concern for residents. Discussions ranged from fear of possible contamination to claims of actual contamination in private water wells. The following resident discussed the belief that his water well had been contaminated due to the natural gas development:

Interviewee #5: I've drank [my well water] for 40 years and never bothered me or anything, never tasted funny. And then, all of a sudden, when they fracked, they just got this real weird smell coming off it. And, you couldn't drink it. Even the horses wouldn't drink it. So if the animals won't drink it, you know something's wrong. EM: Did you ever have your water tested? Interviewee #5: Yeah. And it came back with all kinds of crap in it. Even traces of cyanide.
Other residents worried about the possibility of contamination. These fears stemmed from a lack of understanding of the technical nature of high-volume horizontal hydraulic fracturing, as well as the lack of research regarding the long-term impacts of the process, such as what happens as well casings degrade over time. One resident stated:

Interviewee #8: They can't tell me that all this water if protected. Even if it is ten thousand feet down, it's going to get up in our wells. Then what are we gonna do? They're not going to bring water to everybody.

Another resident described fears over the possibility of accidents and leaks, as well as evidence regarding the natural gas industry releasing waste water into waterways:

Interviewee #9: Trucks may accidentally have a fuel leak, a wreck, fuel spills. They've even documented the release of production water into tributaries. Clearly documented.

There was a sense amongst residents that the natural gas industry was playing Russian roulette with the frequency of accidents and leaks, and a pervasive mistrust of what the industry told them, given that certain companies had been found not to follow the regulations in place. An incident frequently mentioned involved the loss of a scenic waterfall due to Chesapeake’s illegal filling of a stream (The Associated Press, 2012).

Other interviewees stated they had not noticed any environmental pollution, or were convinced the natural gas industry would prevent any contamination. These interviewees had signed natural gas leases, and were drawing royalties.

Interviewee #12: We lived that close, we don't...from the site itself, we don't get any fumes or anything. And we're right there, we don't have any odors of any type.
Interviewee #2: My husband went there and saw how they guarded the water system, and were satisfied that it's not going to cause any trouble. Because the first thing I told them when they came to talk to us about drilling on our property, I drew them a glass of water, and [laughs] to them each, said now drink this water, and I want this water to stay the same when you're done. [Laughs] And drink it again when they're done. And it's very good water they said, and I said yes but please keep it that way. […] They have guarded it down for thousands of feet. And it's not going to seep into our well.

These residents describe greatly different experiences than the previous residents, and place trust with the natural gas industry.

Health Impacts

While fear over health problems was widely discussed, particularly in regards to long-term exposure, two residents discussed health impacts they were currently experiencing that they believed were due to the hydraulic fracturing activity and the air pollution from the natural gas well pad on their property. These residents did not own their mineral rights, and therefore had not signed a natural gas lease for the activity that was occurring close to their home. Water testing had been conducted on their water well after it began to give off a strong odor. The results showed several chemicals, including traces of cyanide. However, since water testing had not been conducted before hydraulic fracturing began, there is no evidence to prove this activity caused the contamination. These residents are currently in litigation with Chesapeake Energy, and were therefore restricted in what information they could share. They stated:

Interviewee #5: The kids and my wife, all them get nosebleeds real bad after they started this fracking. And every time they start drilling, like over on the wellpad again, they're drilling and all that stuff's coming this way. They're getting nosebleeds and stuff, which I haven't got it yet, but I really feel bad and stuff. If you sit out here and breathe that stuff for an hour or two, you can't even come out and work hard without breathing. At
night you can come outside, sit out by the lights out there, you just see all sorts of flakes and stuff. Particulates, floating through there. And then they tell you, oh no, there's nothing like that happening.

Interviewee #6: Getting bald headed and everything. [Laughs] Breathing problems, and-
Interviewee #5: Everyone on the ridge here has started losing hair.
Interviewee #6: My whole body hurts.
Interviewee #6: Sore throats. Congestion, and everything else, every day.
EM: Have you noticed more illness in the children?
Interviewee #6: Yes. [Crying]
EM: Like respiratory type illness?
Interviewee #5: Yeah, they got a cough and stuff right now, the two little ones. [...] And they don't do it continuously, but every day you hear them coughing and stuff.

Residents were distressed over the lack of research into the long-term impacts of hydraulic fracturing activity. One resident cited problems he had heard of from natural gas sites in the western part of the country:

Interviewee #8: I'd say you'll probably see health problems twenty, thirty years down the road. Not now. Any time they come into a place-look at out West, all the people are sick now, and they've been out for years out there.

In regards to health impacts related to unconventional natural gas development, considerations should include both the immediate impacts and the largely unknown long-term and cumulative impacts.

*Environmental Regulation*

The lack of environmental regulation was a concern frequently brought up among residents, with many residents claiming the state is failing to adequately protect the environment, and in turn the health of the residents, from the damage of this development.
Interviewee #10: You know, there's the whole environmental aspect, there are never enough eyes to watch things. Not enough state eyes. And so, it really becomes dependent upon people who are willing to take pictures, to make phone calls, to keep an eye on things. So that it does get done in a reasonable manner.

These fears tie in with themes over the lack of trust in public safety and concerns about political corruption. As mentioned above, residents were also aware of companies frequently not follow the regulations already in place, supporting their suspicions.

*Carbon Footprint and Energy Independence*

Natural gas is often toted as an environmentally friendly fuel, in that it does not release the high levels of carbon dioxide seen with burning coal and oil (Waples, 2012). One interviewee discussed the need to consider the entire environmental footprint of the natural gas drilling process:

Interviewee #1: If you sell it as an alternate fuel, a bridge fuel, clean fuel, always has some truth to it, but it's also misleading because it's not the complete picture. I think the information we're told is being unrealistic about the total carbon footprint of natural gas. You have to go cradle to grave. The total amount of pollutions from the time you push dirt to the time you turn on the burner on your cookstove [...] If you look at the tens of thousands of gallons of diesel that are being consumed on one well to get gas to my house, we have to account for that. [...] There's a lot of unknowns in this equation. We're doing a disservice if we simplify it. How much cleaner is it? [...] We never ask that question. It's a disadvantage because it lulls people into a sense of this is all great, this is all wonderful.

This resident as well as others mentioned energy independence, often in terms of a reason to promote natural gas development:

Interviewee #1: If you look at this from the macro, a lot of this is being sold as United States energy independence, which I don't think there's any truth to justify this activity [...] The companies who are supporting a lot of this activity like to see some other countries benefit as well by being able
to buy gas at a higher rate than they can sell it here. So that would be energy independence for some other people.

Many residents seemed uncertain as to how much natural gas development was actually contributing to energy independence, particularly given recent news of gas exportation overseas.

Community Cohesion and Social Capital

Increased tension within the community, including the erosion of community bonds and social capital, was a theme easily picked up on by interviewees’ discussions. Every resident interviewed discussed some level of community discord created by the natural gas development, with the tensions usually between neighbors who own mineral rights and those who do not, and neighbors who have signed a natural gas lease and those who have not. Even increased strain between family members was discussed, over deciding whether or not to lease family land. Increased conflict within the community was the most frequently discussed topic under the main themes (see Table 2).

Discussions of tensions between residents and the varying perceptions among residents regarding their experienced impacts reflect the research of Brasier et al. (2011) and Theodori (2009). The following statements are from residents who were personally benefitting monetarily from the natural gas development, through a lease and/or as a small business owner:

Interviewee #2: I think it's jealousy and ignorance, is causing the problems [...] I have been listening to these complaints and the bad publicity in the newspapers, and I don't understand what's going on. Whether the other companies are doing a bad job, or the people themselves just don't understand. But it's been all positive for us.
Interviewee #3: We got a neighbor out there who complained about the noise. I don't know because I can't even hear. [Laughs] Now we've never had a problem. We don't know anything about how anyone else does it. Except Stone Energy. That's all we know about.

Interviewee #12: We have friends that are not...well, they are against it because they're not getting their mineral rights, but we're still friends. And we don't argue over it or nothing, we just say ah...[laughs]

Interviewee #11: Well, I had one friend who was spouting off about it, and I thought about saying something, and then I said it's not worth thirty years of friendship to say something.

One resident who was completely surrounded by active rigs but had not leased his own property suggested that he believed neighbors drawing royalties from natural gas leases were greedy and unwilling to work to make their own money. This opinion was shared by certain residents who viewed signing a natural gas lease as taking the easy way out:

Interviewee #7: I've gotten into it with the idiot next door here. There's a lazy, worthless bunch over there on this side, and worthless bunch on that side.

Other residents described the community conflict as having been purposely created by the natural gas industry, in order to gain increased control over the community:

Interviewee #4: It's hard. Neighbors against neighbors, and even some of the families too. But that's exactly what the gas company wants [...] They don't care about my problems. All they're wanting is to get the gas out of the ground. I'm concerned about neighbors' problems. People out there, they ain't.

The following resident provided insight on the deterioration of community experienced during the rapid development of small rural communities for resource extraction:

Interviewee #10: The gas guys came in and said we're going to cure every problem we create and we build communities, and all that. And the fact is that they don't make a place a better place to live. You can't develop the Marcellus and not lose some wild and wonderful West Virginia. [...] In
our neighborhood here, just the fact that they have bought up some properties, we have fewer people, fewer residents here, then we did five years ago. So. Are they good for the community? They paid premium dollars for those properties, and the people that sold those properties are happy. They were able to get out of a bad situation. But the fact is, there's fewer people here. So, what is the function of an area? Is it to produce energy, or is it to produce residents? They can't get the gas out of the ground without taking something from people.

This statement ties into the discussion of trends of decreasing populations in modern natural gas boomtowns, as discussed by Mayda (2011), as well as the loss of social capital discussed by Sampson et al. (2011). This resident goes on to describe the reduced quality of life associated with the development:

Interviewee #10: So, if you own no minerals, and you live on a gravel road, you're gonna suffer from the impact. And people will say, well, he or she's just disgruntled, 'cause he's not getting anything. Well, the fact is if you can't sit on your front porch, you can't hang your laundry out anymore, and you used to be able to do that, then something's taken from you. So there are inherent problems with the process.

This reveals how intangible aspects of residents’ lifestyles and a sense of community are lost through this form of development.

Conflict with workers from the natural gas industry was also discussed, and a heavier focus was given to this form of conflict than was expected prior to data collection based upon previous studies (Brown et al., 2005; Jacquet, 2009; Brasier et al., 2011). These workers tend to be young men from other regions of the country, such as Texas and Oklahoma. Conflict included confrontations with angry words exchanged, and a sense of a lack of respect from the workers. The following statements are from interviewees who either did not own mineral rights or had not signed a natural gas lease:

Interviewee #7: Nothing's easy with these people, they think they can walk on top of you.
Interviewee #4: They just gonna come in here and take everything. But anyway, there's a lot of that. The biggest thing for me is the negativity and lack of respect they have for the people. And the corruption.

Interviewee #5: We got off on the wrong foot to start with […] So they pushed me around, and there wasn't much I could do about it. The state won't stand up to them for me. […] Oh, they keep lying to you, and they're rude. They stop by here by the gate and urinate in the road. I've called cops and everybody else about this […] I said, you know my granddaughter's here every couple of weeks, and stuff, and I don't like this shit happening. You know, they told me, he said well, as long as they don't shake it at you there's nothing you can do about it. I just about bust him right in the damn mouth, that's how—that pissed me off […] These people, I'm telling you, they have no respect for you at all.

These residents viewed the natural gas workers as outsiders to the community, and therefore as not sharing the same concerns as the residents, with their prime motivation being profit as opposed to community cohesion. These discussions fed into talks over issues of trust, both of these ‘outsiders’, and of corruption occurring among the local law enforcement and politicians. This is creating the loss of a sense of public safety and service within the community, which leads to a sense of helplessness among residents to change the situation. Residents stated:

Interviewee #4: There's corruption, a lot of corruption, in this stuff. This goes down to the local politicians. Even the sheriff, they hand him big 8,000 dollar checks, you know they're buying him off.

Interviewee #5: And the sheriff, they're just as disrespectful as goddamn Chesapeake is. Because Chesapeake went and bought them a new cruiser and all this, you think they're kissing butt, that's what they're doing.

A natural gas industry website confirms that Chesapeake Energy Corporation makes vehicle donations to local law enforcement as part of “giving back to the community” (Carto, 2013, para. 1). It is evident certain residents viewed this donation in a negative
light, suggesting the company was attempting to buy the local law enforcement in order to sway their power to the side of protecting the industry over the community.

Following this lack of trust, one interviewee described natural gas workers bluntly lying. His words also reveal the general lack of knowledge residents had about the technologically complex process of high-volume horizontal hydraulic fracturing when development began in the community:

    Interviewee #5: When they come in they told me that they would not be using no chemicals to frack with and all this and that stuff. And I was stupid enough to believe them before I knew better. […] I don't know, these people they've lied to me, and lied to me, and lied to me. They told me they were drilling a new well and stuff when I got to bitching about the water. They went so far as to get a permit with Wetzel County to drill me a new well. And then they came to me one day and said, oh we're not doing nothing now. We're done. […] there's no way I'd take their word again.

This lack of trust is creating fear and anger in the community, as residents are unsure what and whom to believe.

Other interviewees stated they had no problems with the natural gas workers, and even described them as being friendly. These interviewees had signed natural gas leases and were drawing royalties, or were small business owners.

    Interviewee #2: So I'm just very pleased with how Stone Energy has handled their part of the deal. I can't say nothing for any other company, but Stone is doing a very good job.

    Interviewee #12: I have had no issues with them, they always treat us nice, respectful.

One interviewee believed the reason other residents were not being treated with respect by natural gas workers is because they themselves were not treating the workers with respect. He went so far as to describe his neighbors as idiots for their overreactions:
Interviewee #11: We treat them with respect […] Mutual respect from everybody, gets along a lot better than jumping up and down acting like idiots and cussing and swearing.

Residents who presented positive statements regarding natural gas industry workers specified that it was only the particular company they had leased with which they were discussing, and it was possible the problems other residents discussed could be due to dealing with a different energy company.

Mineral Rights Ownership and Powerlessness

The themes of mineral rights ownership and a sense of powerlessness were frequently brought up in interviews. Outside mineral rights ownership creates a unique dynamic within the Appalachian region, as it goes against the strong belief in private property rights prevalent within this nation. The severing of mineral rights from property rights stems from the legacy of coal mining, and provides energy corporations with greater control over the region (Gaventa, 1980; Glasmeier and Farrigan, 2003).

Residents were cognizant of the power structure that has resulted due to this system. As ties into the previous discussion of loss of trust and public safety, one resident stated the following regarding political corruption in Wetzel County and West Virginia:

Interviewee #4: Down the county court house, the gas company people have been buying [mineral rights] for years. I've heard other people saying it's happened. It's crookedness. […] If I could prove it I'd prosecute them. There's so much corruption in this, and that's been going on for years and years, buying up the mineral rights. But you take 48 acres, say at 3,000 dollars an acre, that's a pretty good chunk of change to steal.

Currently, individual communities have no rights in determining whether natural gas development occurs, as this power lies with the state (Waples, 2012). Given a lack of
strict regulation, this leaves communities vulnerable to the impacts of this form of
development. There is a complete disregard of the precautionary principle in using high-
volume horizontal hydraulic fracturing, leaving residents exposed to possible health risks
that are not yet known, particularly as concerns chronic exposure and the cumulative
effects of chemical mixtures (GAO, 2012b). This has created widespread fear and
uncertainty among residents regarding the hydraulic fracturing process.

A sense of powerlessness and resignation to the current situation was prevalent
among residents. Interviewees who owned their mineral rights felt it was logical to lease,
given that neighbors were signing leases and therefore the negative impacts would be
experienced regardless. In addition, residents often felt they needed the money that came
from the royalties; for instance, interviewees stated the royalties were the main source of
money supporting them in retirement. This adheres to the “forced choice between
pollution and poverty” discussed in Mountains of Injustice (Morrone and Buckley, 2011,
p. 76). Regarding a sense of powerlessness against the energy companies, residents
stated the following:

Interviewee #4: The gas company becomes powerful in the area, they buy
friends and family. They've got the neighbors out here fighting between
each other. That's how the gas company excels. It's the government doing
it too.

Interviewee #7: I wish they weren't here. They're going to be here, they're
here to stay. You can't run them off [...] Once they come in, what can you
do?

Interviewee #12: And yes, we have seen neighbors get upset. But they've
kind of resigned themselves, now they're here and they're gonna stay.
The large amount of money involved with energy corporations was seen as a main cause of powerlessness within the community:

Interviewee #9: Everything revolves around the mighty dollar. The bottom line is, you know, I kind of refer to [the natural gas industry] as children. If you're watching them, they'll do their best. You turn your back, they're doing it wrong.

Interviewee #11: You're not gonna run them out of here. There's too much money involved. Money talks.

Even residents who were vehemently opposed to natural gas development within the community and perceived by other residents as activists discussed the uselessness of trying to stop all development. Instead, they advised that energy could only be spent attempting to regulate the activity, which itself was an uphill political battle. One resident stated:

Interviewee #9: No matter who you are or where you live, if the gas company's coming in your area, don't waste your energy trying to stop it. 'Cause it's coming, the money's too big. If you're going to spend your will, spend it where you can get traction. [...] I honestly feel it can be done environmentally friendly and much safer. And if it's truly going to release us or help us become less dependent on foreign oil, and gas, then everybody should be for it. But you gotta go about it in a smart way.

Interviewees made it apparent they realized mineral rights ownership was the main source of conflict within the community, and created a power structure. The difficult position mineral rights owners are faced with when deciding whether to lease those rights was also frequently mentioned. Residents stated:

Interviewee #2: It all has to do with whether they own mineral rights or not. Every bit of it. [Laughs] There's a lot of jealousy among the natives, and among the new people too. [...]We paid taxes all those years on mineral rights, and nobody was caring one way or another about that, until the benefits started coming here. [Laughs] Now it's a different story.
And I didn't like paying all those taxes either, but we did because we didn't want to part with them. [...] I think who owns the land should own the mineral rights. And so we kept ours that way.

Interviewee #5: It's very obvious out here that if you're a mineral right holder, naturally you hold more power. So you do get treated a little better. But if you don't, then it's disrespect all the way around. 'Cause they know that the law’s behind them all the way, laws and regulations. The surface owner, without the mineral rights, is powerless.

Interviewee #7: The oil boom that they had around here, these people didn't want to keep their mineral rights. That's one of the things that's wrong in this state right here. It matters who has their mineral rights.

Interviewee #11: The people that don't have their mineral rights are gonna be upset, to some extent, because I'm sitting here drawing royalties, they're sitting here listening to the same noise, the same traffic, and their drilling, and the same aggravation, their phone lines being torn out.

Similar themes in regards to a power structure surrounding mineral rights ownership has been described in the work of Gaventa (1980) and Glasmeier and Farrigan (2003), and is described as having an influence on Appalachian culture.

The interview questions included the ability for citizens to address any problems that may arise with natural gas development. Residents discussed the difficulty in deciding who to contact about particular problems, as well as an inability to receive a response about concerns:

Interviewee #1: It's very complicated for the average citizen to find who's responsible for what aspect. Is it an air quality problem, is it a leak on the highway, is it road damage, is it trucks speeding-my car was passed by a dump truck going 70. That's just plain stupid. What avenues can you go through? No one knows which avenues, you just try them all. So, but they cannot be easily addressed.

EM: Do you think it's easy to communicate with the gas company?
Interviewee #7: No. You call over there and nobody answers.
The Wetzel County Action Group eventually developed a list of phone numbers to call categorized by problem type, showing the ability of community members to organize in order to address issues.

Two interviewees had a contrasting story, stating they had never had difficulty getting a response from the natural gas industry. These interviewees had signed a natural gas lease and were drawing royalties:

Interviewee #11: For the road, to get the road fixed, I've got a phone number of one of the bosses. He takes excellent care, I mean, he's an honest man. He'll tell you the truth, he'll say if the road gets to dusty, I'll try to get a water truck over, he said maybe I had one broke down. He won't lie to you.

EM: He responds immediately?

Interviewee #11: Right. [...] He will get it done. He don't lie to you.

These statements may imply that residents with natural gas leases are given a quicker response from the industry than other residents.

There seemed a sense among residents that no community should suffer the severe negative impacts of energy development. Residents also recognized that coal, widely extracted in surrounding areas of West Virginia, created many of the same problems. One resident shared insight into the broader picture of global energy development and resource extraction of which Wetzel County is a part:

Interviewee #10: This is an extraction process. An extraction's painful. I don't care if it's coal, or it's oil, or it's natural gas. You know, there's a grizzly aspect to it. If it's not in your backyard, then you really don't know...you don't think about it. You know. You came up here burning oil today, where'd the oil come from? Was it tar sands in Alberta? Do they come from Kuwait, or Ethiopia? If you've watched anything about the oil gathering process in Ethiopia, I mean, it's just horrendous. [...] if you live in the middle of it, then you know what it is, and you know the pitfalls and the things that can happen [...] that's the grizzly aspect.
This statement ties into theories about the Appalachian region serving as a sacrifice zone in order to provide energy to the rest of the nation, as discussed by Scanlan (2011).

The majority of residents interviewed did not believe natural gas development should be completely stopped; rather, they called for better regulation as well as a slower rate of development to protect communities from the experienced harms. Many residents discussed that current practices for natural gas development were “stupid,” but that it could be done “smart,” with minimal impacts on small communities. This would involve having more community input, greater research into the impacts of this activity, heavy regulation, and the development of improved, more environmentally-friendly techniques. However, the current practices were not enough to protect their community, and often residents had to put in a great deal of effort in order to help gain protections. Residents stated:

Interviewee#1: I'm somewhat optimistic that we're going to be able to regulate as well as we can in the community, but by and large, as communities we don't do much until there's a serious problem. As a human race we tend not to have a lot of foresight. [...] This is inherently stupid. So we find smart and we develop a way that is going to accomplish the same ends, that is seamlessly and as cleanly with the minimal amount of impact. It's doable. So I'm slightly optimistic but I think we're gonna [...] create some problems now and then to get better practices.

Unless residents are afforded the basic rights and protections mentioned above, anger at and mistrust of the natural gas industry will continue, and communities will be divided.
CONCLUSION

This case study addresses research gaps in residents’ perceptions of the impacts of unconventional natural gas development, as well as the causes for variation in these perceptions. Economic, environmental, and social impacts were discussed in interviews, with both long-term and short-term impacts identified within each focus area. The major social impacts identified include a decreased quality of life, loss of rural lifestyle, and a loss of community cohesion. Interview responses revealed that perceptions of these impacts were influenced by whether a resident was personally benefitting from the natural gas development. This study was conducted within an Appalachian context, and aspects apply generally to energy extraction within rural communities.

This story is another piece of the extensive history of resource extraction that has occurred within the Appalachian region, which has created significant, even long-lasting impacts for the residents of this region. Within this economically depressed region, the extraction of natural resources is often touted as a means to bring jobs and money to revitalize the region; yet, history has shown the main benefit of this extraction has been to energy companies and outside areas of this nation, with the Appalachian people left with environmental devastation and health problems. It is important to pause and reflect on this pattern, in order to potentially change this downhill path.

Varying Perceptions

As seen throughout the excerpts in the previous section, residents’ descriptions of experienced impacts varied widely, and at times information in one interview is
seemingly contradictory to another, showing the importance of perspective. This is concurrent with previous research on community impacts from natural gas development, including the work of Brasier et al. (2011), and Theodori (2009). Residents portrayed a range of knowledge regarding issues associated with natural gas development. A few residents seemed completely unaware of the negative impacts their own neighbors claimed to be experiencing. It was clear that the technical aspect of the hydraulic fracturing activity confused certain residents, who tended to trust what the natural gas industry told them about the impossibility of water contamination. Other residents claimed to have been ignorant at the start of natural gas development, but have since educated themselves in depth on the processes involved: one interviewee had become an expert on air pollution issues associated with natural gas development, while another interviewee spent considerable time watching the activity, in order to report violations to the EPA.

Analysis of residents’ responses in terms of their background reveals that the major determinants to a resident’s perception of impacts includes whether or not he/she is a mineral rights owner and has signed a natural gas lease, or is a small business owner. Interviewees who were personally benefitting from the natural gas development (small business owners or natural gas leasers drawing a royalty) tended to downplay environmental or social issues, describing them more as inconveniences, while focusing on economic benefits. Yet even certain residents who both own their mineral rights and have a natural gas lease signed reported negative impacts, although they tended to present
a more balanced picture through weighing the positives with the negatives, as well as looking at this development in terms of other forms of energy development.

Small business owners in the community also tended to have more positive perceptions of the natural gas development, focusing on their own increased business. Of the three small business owners interviewed, two described minimal negative impacts, while one described an equal split between positive and negative impacts. With the exception of one small business owner, these interviewees did not discuss pollution issues except to say that the natural gas industry was successfully preventing any problems from occurring. In addition, quality of life issues such as traffic and loss of social capital due to community breakdown were described as not being major problems, but rather termed as an inconvenience. These interviewees even described other residents as being dramatic, often using the word “jealous”, in their reactions to the natural gas development.

The work of Brown et al. (2005) claims that pre-conceived notions on energy development may impact the attitude of residents, creating a variation in perceived impacts. Within this case study, this may be a factor in determining how residents discuss experienced impacts. Residents who decided to sign a natural gas lease and are therefore benefitting from this activity likely had a positive connotation in regards to energy development originally, which influenced their decision to lease. In addition, residents with a negative view of natural gas development are more likely to decide not to sign a lease (if they own their mineral rights and can therefore make this decision), which would result in no personal benefit from the activity and a continued portrayal of negative
views. Studies that survey residents’ perceptions of natural gas development prior, during, and post development would provide a clearer notion of this factor.

One outlier stood out in the interview responses: a resident who is a small business owner, drawing royalties from a natural gas lease, and a self-described nature lover. He presented both sides of the issue, claiming there were some major economic benefits from the development yet at the same time significant environmental and social consequences. He was particularly concerned about deforestation and noise pollution that was occurring on and near his property. He was also able to fit this local natural gas development into the wider picture of energy development occurring throughout the world. Given the small sample size, there are likely a substantial number of residents who share this split viewpoint.

Spatial Variance of Impacts

The variation in impacts described by residents in the previous section suggests an unequal distribution of problems and benefits within the community, with a distinct spatial variance. Interviews revealed a division between the town of New Martinsville and the surrounding rural community. The natural gas development is located in the rural regions, with a heavy concentration of well pads in Victory Field (see Figure 5). The residents in this region daily experience the increased traffic, air pollution, noise, and bright lights associated with this activity, as well as decreased housing values. In contrast, the town of New Martinsville is benefitting economically from this activity, with increased local business due to the natural gas workers. The majority of negative
impacts do not extend into town, with the exception of increased traffic. This is concurrent with the findings of Brasier et al. (2011).

Within the rural communities, further unequal distributions exist. One contrast is between mineral rights owners and those who do not own their mineral rights. Another disparity exists between those who have signed a natural gas lease and those who have not. Those who own their mineral rights and have signed a natural gas lease are receiving an economic benefit, and generally tend to receive better treatment from natural gas industry employees. Residents who do not own their mineral rights can experience development on their property without any input or royalty payments, receiving only a one-time property damage fee (Waples, 2012). Residents who own their mineral rights but have not signed a natural gas lease still experience the negative impacts when development occurs on a neighboring property. These divisions are responsible for increased conflict between neighbors and even between family members.

It is also important to consider the fact that the economic benefits of natural gas development are being experienced outside of Wetzel County, reaching the pockets of various members of the energy industry. In addition, the cheap energy supplies are being exported to other, wealthier areas of the nation, and increasingly overseas (Scanlan, 2011).

Implications for Actions

This research provides a more complete understanding of the impacts of high-volume horizontal hydraulic fracturing to rural communities. This information is useful
for policy makers and community leaders, particularly in areas anticipating unconventional natural gas development within the near future. While decision makers tend to focus on potential health impacts of unconventional natural gas development, it is important to realize a wide variety of negative impacts are tied to this activity. This includes quality of life, a sense of community, and the psychological harms of incessant fear and uncertainty. Additionally, evidence suggests that the economic advantages are often not as great as initially anticipated. Weighing the range of issues involved with unconventional natural gas development allows for a fair analysis of the issue, as well as the need for mitigation measures. Of particular concern is the need for better regulation and monitoring of this activity, as was repeatedly mentioned in interviews. This would serve to help moderate many of the discussed impacts, and relieve the psychological strain.

Recommendations for Further Research

The findings of this study provide openings for further research within the fields of sociology and environmental studies. The limitations of this study can be supported with future case studies employing both qualitative and quantitative methodologies. The inclusion of communities with variation in size, location, and demographics, will further complete the story of unconventional natural gas development. Additionally, studies should be conducted over a range of timeframes, providing information as to impacts at the initial phases, during, and after natural gas development. Multi-year case studies will provide information on the long-term and lasting impacts of this activity, as well as
provide a story of change to community structure. Environmental justice implications were discovered through the major themes in the interviews, including spatial variance regarding the benefits and harms of this activity, a power structure involving mineral rights ownership, and a sense of powerlessness amongst residents, which should be explored with future research.

While the topic of unconventional natural gas development is highly controversial, it is important to investigate all aspects of this activity. The voices of residents tend to be buried beneath the scientific data and industry claims, and it is imperative for researchers to listen to those who are most impacted. This study presents the perceptions of the residents of Wetzel County, West Virginia, and explains how their experiences fit into the larger picture of resource extraction in the Appalachian region.
REFERENCES


APPENDIX

Appendix A: IRB Approval Form

Office of Research Compliance
RTCC 117
Athens, OH 45701-2678
T: 740.593.5654
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www.research.ohio.edu

A determination has been made that the following research study is exempt from IRB review because it involves:

Category 2. research involving the use of educational tests, survey procedures, interview procedures or observation of public behavior

Project Title: The Social Impacts of Energy Extraction on Rural Communities: A Case Study of Hydraulic Fracturing in Wetzel County, West Virginia

Primary Investigator: Elizabeth Margaret Migliore

Co-Investigator(s):

Advisor: Natalie Kruse

Department: Environmental Studies

Robin Stack, CIP, Human Subjects Research Coordinator
Office of Research Compliance

The approval remains in effect provided the study is conducted exactly as described in your application for review. Any additions or modifications to the project must be approved (as an amendment) prior to implementation.

Date: July 27, 2012
Appendix B: Wetzel County Interview Questions

Interview #

Interviewer: Elizabeth Migliore

Interviewee:

Date:    Time:

Research Topic:

Focus on the social impacts of hydraulic fracturing, as perceived by the residents of Wetzel County. This interview will be analyzed using an environmental justice framework.

Format: Semi-Structured Interview

Greetings, read consent:

____________, this is an interview for my graduate thesis at Ohio University. The purpose of this research is purely academic, and will not be used for any other purpose. Furthermore, all interviewees will be kept anonymous for privacy protection. That being said, you still have the right to refrain from answering any question, end the interview if you see fit, and may request a transcript of the interview when my research is complete. This interview will be recorded using a digital voice recorder. At the conclusion of the research, the recording will be deleted.

Do you give your permission to continue? ______________ (verbal “yes” or “no”)

Interview Questions:

Can you tell me a little bit about yourself? ______________ (not to be shared)
Age?
Career?

What has been your experience living in Wetzel County?
Length of Residence?
Homeowner?
Positive/negative aspects?

Do you own your mineral rights?
Have you signed a natural gas lease?

Do you have a well pad on your property, or on a neighboring property?

Did you notice any changes when natural gas development began in the area?
Environmental?
Economic?
Infrastructure?
Housing prices?
Quality of life?
Conflict within community?

What are some positive aspects you believe natural gas extraction brings to the region?
Jobs?
Increased business?
Money from leases?
Other observations?

What are some of the negative aspects you believe natural gas extraction has brought?
Environmental?
Health problems?
Aesthetic?
Increased traffic?
Degraded infrastructure?
Other observations?

Do you at all feel as if you have been unfairly treated due to the development of the natural gas industry in your community?

Do you feel as though any problems that may arise due to natural gas extraction in your community can be easily addressed? What avenues can you go through to address any concerns?

What have we not talked about that you feel should be discussed?

Is there anyone else that you recommend I talk to?
Appendix C: Selected Interview Quotations by Theme

Economic Changes

Interviewee #1: There has been a short increase for some of the local businesses like the restaurants, hotels, gas stations, hardware stores, things like that.

Interviewee #2: There's been jobs, lots of jobs created.

Interviewee #2: Restaurants, and motels, and our gun shop has benefitted a lot because these oil and gas men are outdoor people, they come and buy our guns. We never expected to benefit this much in this business. But, it's so busy now we can't hardly keep up with it. So it's been nothing but positive for us, in every way.

Interviewee #4: The local business, your eateries and hotels and stuff like that, are doing okay. I think the local town people are doing alright.

Interviewee #5: I think it sure costs the landowners a lot of money because our property was 3,000 dollars an acre, and it's dropped down now to 7 to 800 dollars an acre. Of course, the taxes hasn't dropped any. In fact, mine's almost doubled.

EM: Who do you think is benefitting from this gas development?
Interviewee #5: I think Chesapeake. And maybe some of our higher officials. Yeah, they're probably getting a bit of it. Well, I know one of them is.

EM: Did you notice any economic benefits of the natural gas development?
Interviewee #7: Not to me I didn't. When they had water out here on the gravel part of the road-I got that stopped-I would drag it around under my truck, and it cost you money. We were dealing with the dust, then they created a bigger problem by trying to keep the dust down. The limestone turns to a cement. …it tears your vehicle up underneath. You're dragging this stuff around. You have to go get it cleaned, and that's money out of my pocket. It's not out of theirs, it's out of mine, because of what they're doing. Before this, maybe once or twice a year, I have to change the brakes on it. Three times a year now I have to change the brakes on it.

Interviewee #9: I try to look at this, as far as job creation, I try to look at the long-term benefits. What I've witnessed over the last five years, being involved with this type of development, there's tons of short-term, as far as long term it's very minimum. Very. For the scale that this is. As far as employment.

EM: Do you see the employment equaling economic benefit to the community, in the same way it's short-term economic development that will not last?
Interviewee #9: Oh, absolutely. It's just history repeating itself in a different form. When Wetzel County alone was at its peak of drilling, with not just Chesapeake's operation but Stone Energy and other drilling companies in the area, Wetzel County had the highest unemployment rate ever. Why is that? That don't make sense does it? But that's one of their trump cards that they play all the time, the gas development: jobs, jobs, jobs. Well you can't argue with it. It does bring them, but they're very short-term. Once they operation's up and running, a twelve compressor station, two people can run it. Two people.

Interviewee #10: certainly there are more people hired than there were. The unemployment rates don't really show that for Wetzel County, but, you know, anybody around who is of worth, you know, has been able to get hired on I think.

Interviewee #11: I know two local people, and I won't mention their names, that are employed-two local residents-with the gas, with Chesapeake. I'm sure there's more, and I know Littman Excavating has hired a lot more people. I don't know exact figures, but you can see their trucks all over the place. And they use local people too.

Interviewee #12: And the restaurants have been busier, and the motels.

Interviewee #11: And another thing. Let's face it, New Martinsville's a nice little quaint town, but the motels were hurting for money because who's gonna come here for a vacation? There's no really great tourist attraction, I mean, it's pretty, the country's pretty, but you're not going to drive from say New York or any big city, Cleveland, or something, just to come here for a vacation. There's not much to do here.

Interviewee #11: All the coal mines and the big fire plants previously, all the fire plants and coalmines are in either Marshall or Ohio counties, so the tax base is basically the individual taxpayers. Which you pay on the money you receive on your royalties, between eight and ten percent goes to the state off the top. So for every thousand dollars you make, say you make, you owe them one hundred dollars. So it's kind of helped.

Interviewee #12: And the county taxes, those are going up.

Interviewee #11: And West Virginia's one of the few states that isn't in the black yet. I'm not saying it's because of the drilling, but it has been, and this will help naturally.

Housing Prices/Land Value

Interviewee #2: It's not fair. But some people have raised the rent a lot just because they could.

Interviewee #4: I could see people coming up here and saying I don't want this damn farm with all this traffic coming up it.
Interviewee #5: I think it sure costs the landowners a lot of money because our property was 3,000 dollars an acre, and it's dropped down now to 7 to 800 dollars an acre. Of course, the taxes hasn't dropped any. In fact, mine's almost doubled.

Interviewee #7: Who's going to buy a house with all this? A one lane road with traffic like this. I mean I don't ever plan on leaving, you know, but if we had to, then we can't sell it.

Interviewee #10: you can just look at the traffic in New Martinsville, which people bitch about now. [laughs] But, you know, that's a result of gas guys, lots and lots of gas guys in New Martinsville.

Conflict with Natural Gas Industry Workers

Interviewee #2: So I'm just very pleased with how Stone Energy has handled their part of the deal. I can't say nothing for any other company, but Stone is doing a very good job.

Interviewee #4: They just gonna come in here and take everything. But anyway, there's a lot of that. The biggest thing for me is the negativity and lack of respect they have for the people. And the corruption. There's corruption, a lot of corruption, in this stuff. This goes down to the local politicians. Even the sheriff, they hand him big 8,000 dollar checks, you know they're buying him off.

Interviewee #5: we got off on the wrong foot to start with […] So they pushed me around, and there wasn't much I could do about it. The state won't stand up to them for me.

Interviewee #5: Oh, they keep lying to you, and they're rude. They stop by here by the gate and urinate in the road. I've called cops and everybody else about this. And, one of them, the dude that's head sheriff now, he's worthless sometimes, and I told him so right out to his face. But, he came out here and I told him, I said, you know my granddaughter's here every couple of weeks, and stuff, and I don't like this shit happening. You know, they told me, he said well, as long as they don't shake it at you there's nothing you can do about it. I just about bust him right in the damn mouth, that's how-that pissed me off. That's ridiculous. And the sheriff, they're just as disrespectful as goddamn Chesapeake is. Because Chesapeake went and bout them a new cruiser and all this, you think they're kissing butt, that's what they're doing.

EM: Do you think that since the drilling activities occurred in this area, in your opinion, has the use of drugs and crime gone up? [Baby babbles]

Interviewee #5: Definitely. Yep. I know it has, especially drugs.

Interviewee #5: These people, I'm telling you, they have no respect for you at all.

Interviewee #7: Nothing's easy with these people, they think they can walk on top of you.
Interviewee #11: We treat them with respect. Like I've got a favorite saying, when the law enforcement officer stops you from speeding, you don't kiss his butt but you sure as heck don't spit in his face either. You know? Mutual respect from everybody, gets along a lot better than jumping up and down acting like idiots and cussing and swearing.

Interviewee #12: I have had no issues with them, they always treat us nice, respectful. How you doing, you know. Just always been nice.

Increased Conflict within the Community

Interviewee #2: I think it's jealousy and ignorance, is causing the problems.

Interviewee #2: I have been listening to these complaints and the bad publicity in the newspapers, and I don't understand what's going on. Whether the other companies are doing a bad job, or the people themselves just don't understand. But it's been all positive for us.

Interviewee #3: We got a neighbor out there who complained about the noise. I don't know because I can't even hear. [Laughs] Now we've never had a problem. We don't know anything about how anyone else does it. Except Stone Energy. That's all we know about.

Interviewee #4: It's hard. Neighbors against neighbors, and even some of the families too. But that's exactly what the gas company wants.

Interviewee #4: They don't care about my problems. All they're wanting is to get the gas out of the ground. I'm concerned about neighbors' problems. People out there, they ain't.

Interviewee #7: I've gotten into it with the idiot next store here. There's a lazy, worthless bunch over there on this side, and worthless bunch on that side.

EM: Did you notice any conflicts within the community? Like between neighbors?
Interviewee #9: Absolutely there's conflict. Some people think that this gas development is the best thing since sunshine. Course, everybody's entitled to their own opinion. Course, now that's going to bring controversy between neighbors and friends and family. Course, again that's all on whom you ask.

EM: Have you ever had any bad experiences or confrontations with people from the natural gas industry?
Interviewee #9: We've had a few choice hard words from time to time. But, I always try to work it out. I never like to argue with anybody. I choose not to argue. And I don't present a case unless I have the facts, know for sure. So yeah, I mean, there's been times I've had some pretty harsh discussions about issues going on in the gas fields in our area.
Interviewee #10: One of the sad things about living in the country is feuding. And so feuding's gone on forever, and this is another reason to feud.

Interviewee #11: I don't get along with some of these people, and again I won't mention any names, but they've got a right to speak what they think. As well as I do for them. Interviewee #12: We have friends that are not...well, they are against it because they're not getting their mineral rights, but we're still friends. And we don't argue over it or nothing, we just say ah...[laughs]
Interviewee #11: Well, I had one friend who was spouting off about it, and I thought about saying something, and then I said it's not worth thirty years of friendship to say something.

Air Pollution

Interviewee #1: Obviously, air quality is a problem. And is one of the ones I've heard other people complain about also. When you have all these diesel trucks, you're adding lots of fumes to the air. This happens at every frack site: silica dust, happens daily, hourly. From the time you start pushing dirt, you're burning diesel fumes. If there's a slight delay on the roads, there's a backup of all these trucks burning diesel fumes. We've had neighbors complain about all the diesel fumes in front of their house. This is a significant increase and if it's a significant health issue, we don't know. It's that type of air pollution that is difficult to track your exposure to. So there's air pollution, water pollution. It's not uncommon to see sedimentation issues...

Interviewee #4: I can't breathe, I can't take this dust [...] You can't keep your windows open or nothing.

Interviewee #6: Yeah, and the rain-the rain here is red. That cooler we put next to the house got red on it.
Interviewee #5: This isn't the only place I've witnessed it. After deposits in it dries out, I was told it's a red iron oxide color.
Interviewee #6: But that cooler, you just tip it over and it's red.
Interviewee #5: It's the damnest thing I've ever seen. Hard to really pin on why or where it comes from, but it never used to be an issue, before they was here.

EM: Have you had any health problems related to the activity?
Interviewee #8: Cleaning problems. [laughs] Every time I turn around I have to clean my windows. It's just in the air.
EM: Do you ever smell anything in the air off these wells?
Interviewee #7: Well, there's like a steam coming up off them.
EM: But you don't know if it's really steam?
Interviewee #7: No, it's not steam.
Interviewee #8: When their pipes were laid down [inaudible] When they were forcing the chemicals down into the ground, we could smell it.

Interviewee #9: Environmental problems are everywhere with it. Just the air emissions of construction of well sites, along with the traffic that comes with construction of the well sites, developments of compressor stations, every type of piece of equipment you got running, is the air.

Interviewee #12: We lived that close, we don't...from the side itself, we don't get any fumes or anything. And we're right there, we don't have any odors of any type.

Interviewee #4: Just the noise and dust, putting up with the dust, it's awful. It use to be blacktop down here but they cut it out and replaced it with limestone. Limestone creates silica dust which will kill you. And I was exposed to that when I was a brick layer and my lungs ain't no good, but the dust, they try to keep it watered down but it ain't enough. There's just so many different things.

Rural Lifestyle

Interviewee #2: I love West Virginia, and I love American Ridge where I live. I'm just very happy where I live.

Interviewee #4: This old country use to be like John Denver's country, but now it's coal country-not coal-gas country haul roads just like the coal country haul roads.

Interviewee #7: I like the country. Used to be a lot better, it's not that good now.

EM: In other words, how did this activity affect your everyday living?
Interviewee #7: Mainly the traffic, and the roads. And our phone line, since this activity started-longest time we didn't have phone service was about three weeks. I couldn't have called 911 'cause we don't get cell service out here.

Interviewee #7: When you move out here you move out here because of the quiet, you know, the solitude. I ain't getting that now. Forget that. It's taken what we know as country living, and it's turned it completely upside down. They ruin your way of life.

Interviewee #9: It's a lot easier to tell you what I used to like about it. Was the peace and quiet. That went along with country living.

EM: Did you notice any changes when gas development began in the area?
Interviewee #9: Everything changes.
EM: Specific examples?
Interviewee #9: Road damages, the lack of appreciation for water and the environment. The safety of the roadways, the freshness of the air. That comes along with country
living. Noise. Lots of noise, constantly, from the well development and also the pressure stations running. Lighting pollution from the pressure stations. Depreciation of property value. People's attitude.

EM: And did you notice any changes in the area when natural gas development began?
Interviewee #10: Fewer trees, more dust, more noise, more trucks.

Traffic

Interviewee #4: A lot of changes. A lot of big truck traffic. When they did fracking, all them big sand trucks would come in through here, night and day right up past my farm. [Laughs]

Interviewee #7: Early in the morning you better watch your tail when you come up that main road. I mean they're flying, trying to get to work.

Interviewee #8: there's hardly a day when you go into town you don't see somebody from the gas company. Night or day.
Interviewee #7: Traveling like a bat out of hades, the traffic.
Interviewee #8: And they don't move over for you. They're used to the cities where they don't have to move over. So everybody that lives here is just afraid coming up the road. You're the one that stops and moves over, not them.

EM: How has traffic changed in the area?
Interviewee #9: Well, traffic in my area is probably cut eighty percent now, because we only have one drilling rig down there. But when they were drilling and fracking, having six, seven rigs standing in the area, it was a nightmare twenty-four seven. Safety on the roadways. It was very high, the death rates.

Addressing Problems with Gas Industry:
Interviewee #1: it's very complicated for the average citizen to find who's responsible for what aspect. Is it an air quality problem, is it a leak on the highway, is it road damage, is it trucks speeding-my car was passed by a dump truck going 70. That's just plain stupid.
What avenues can you go through? No one knows which avenues, you just try them all. So, but they cannot be easily addressed.
EM: Do you think it's easy to communicate with the gas company?
Interviewee #7: No. You call over there and nobody answers.

Interviewee #11: For the road, to get the road fixed, I've got a phone number of one of the bosses. He takes excellent care, I mean, he's an honest man. He'll tell you the truth, he'll say if the road gets to dusty, I'll try to get a water truck over, he said maybe I had one broke down. He won't lie to you.
EM: He responds immediately?
Interviewee #11: Right.
Interviewee #12: Yes.
Interviewee #11: He'll tell you I don't know if I can do it today. I'm so tied up today I can't get something done.
Interviewee #12: But he will get it done.
Interviewee #11: He will get it done. He don't lie to you.

**Infrastructure Damage**

Interviewee #1: The largest one has been infrastructure damage, the cost of which we don't at all have a handle on. The state hasn't come up with any way to attempt to recoup all the cost. Is the tax the state has on these industries proportional such that the counties where this damage is occurring, with roads that were not designed for those trucks. Do we have the money to keep up with it? I don't know.

**Infrastructure Improvement:**
Interviewee #2: …we have a better road now than we had before they started. they maintained the roads all winter, even though we had a mild winter, but the little bit of snow we did have they maintained the road instead of the state doing it.

Interviewee #4: You hear people too say how much better the roads are out here. I liked my country road. Nice, quiet country road you could walk out to here. Now, they have just gas company haul roads like coal country haul roads. I use to live up in the coal country, old beat up haul roads up through there. Just torn up. But I liked the way it was. And they say oh look how nice the roads are. [Laughs] But I liked them the way they was. They were John Denver roads then, but now they ain't no more

Interviewee #10: The roads have been narrow, the gas guys have made some of the roads wider. Some roads have actually been improved. If you drove down the road where I live, our road is actually better than it used to be. Up to the well pad. They came up from...we access our house from this way, there's a main road here, and they came up a mile up our road which was always impassible, and put a well pad here. And now you can go up and down with anything. So there are some cases where roads have gotten better. And considerably better.

Interviewee #12: we had two worn out buildings, they tore down out for us. They graveled our driveway twice for us-
Interviewee #11: And put a culvert in.
Interviewee #12: Just because they wanted to.

**Noise**

Interviewee #5: it was nice and quiet out here, you didn't have a whole bunch of people running in and out all the time. And now, I bet there's not an hour that goes by hardly
that there's somebody running in and outta here. They come out here all hours of night and day, and from the gate there down to this next house. They'll use their jake brakes and stuff.

EM: Now that noise from the wells continue all night?
Interviewee #8: The noise that they make...you know, you can hear them [inaudible]
Interviewee #7: [Inaudible] I'm telling you, he couldn't get down further than that garden right there unless he had his jake brakes on. I come up out of that chair right there, I can hear him coming clear around the ridge. All the way around the ridge. RRRRRRRRR. He was loud, real loud. And he started down that hill right here.

Powerless

Interviewee #4: Down the county court house, the gas company people have been buying them for years. I've heard other people saying it's happened. It's crookedness. You can't prove it. If I could prove it I'd prosecute them. There's so much corruption in this, and that's been going on for years and years, buying up the mineral rights. But you take 48 acres, say at 3,000 dollars an acre, that's a pretty good chunk of change to steal.

Interviewee #4: The gas company becomes powerful in the area, they buy friends and family. They've got the neighbors out here fighting between each other. That's how the gas company excels. It's the government doing it too.

Interviewee #5: They paid for a new cruiser when they first showed up here. So they could get them on their side. And they won't do nothing.
EM: Do you think the local law enforcement, since the gas development has come here, protects the people still or the gas company?
Interviewee #5: I think the gas company. Yep.

Interviewee #5: I don't care how much you're out here collecting, how many days, you're not touching the tip of the iceberg. There's so much if you was to go slow and grab everything. Your report would be that tall. [Gestures with hands]

Interviewee #7: I wish they weren't here. They're going to be here, they're here to stay. You can't run them off [...] They're here and that's the way it's going to be [...] I just wish they weren't here. Once they come in, what can you do?

Interviewee #7: They want to do is, they just honeycomb this down underneath. One here, when there, just interlaid. So it's hard to tell what's going to happen.

Interviewee #9: Everything revolves around the mighty dollar. The bottom line is, you know, I kind of refer to them as children. If you're watching them, they'll do their best. You turn your back, they're doing it wrong.
Interviewee #9: No matter who you are or where you live, if the gas company's coming in your area, don't waste your energy trying to stop it. 'Cause it's coming, the money's too big. If you're going to spend your will, spend it where you can get traction. Put all your energy into helping, working with legislation to work on better regulations, stiffer fines, and building a relationship so to speak, of some sort, with the gas company and make them understand why you're doing what you're doing. For the better of the people, not only who live there, but also for their workers. Whether it's on the roadway or the well sites. Protect everything, and the environment. I honestly feel it can be done environmentally friendly and much safer. And if it's truly going to release us or help us become less dependent on foreign oil, and gas, then everybody should be for it. But you gotta go about it in a smart way.

Interviewee #12: And yes, we have seen neighbors get upset. But they've kind of resigned themselves, now they're here and they're gonna stay.

Interviewee #11: You're not gonna run them out of here. There's too much money involved. Money talks.

Interviewee #12: Oh yeah. When they were drilling out past us, people-I know I can't mention names—would get very furious, and they'd go down on the road try and stop them. And such as that. And that's just going a tad too far. You can protest, just...

Interviewee #11: You can protest if you want, put up a sign in your yard: I don't like so and so. That's your right to do that. And not to obstruct the law. I don't care for President Obama but he's still our president. So you've got to live with it.

**Water Pollution**

Interviewee #2: my husband went there and saw how they guarded the water system, and were satisfied that it's not going to cause any trouble. Because the first thing I told them when they came to talk to us about drilling on our property, I drew them a glass of water, and [laughs] to them each, said now drink this water, and I want this water to stay the same when you're done. [Laughs] And drink it again when they're done. And it's very good water they said, and I said yes but please keep it that way.

Interviewee #2: They have guarded it down for thousands of feet. And it's not going to seep into our well.

Interviewee #3: There just ain't no way in this world that any groundwater could be getting in there. I don't see how.

Interviewee #5: Yeah, my water, my drinking water. I've drank it for 40 years and never bothered me or anything, never tasted funny. And then, all of a sudden, when they
fracked, they just got this real weird smell coming off it. And, you couldn't drink it. Even the horses wouldn't drink it. So if the animals won't drink it, you know something's wrong.

Interviewee #5: (water well tested) Yeah. And it came back with all kinds of crap in it. Even traces of cyanide.

Wayne says, he saw down in the creek down there, big old white foam all across. You should see out in the middle of the winter, it melted down all the snow. Snow what, that high? [Gestures] It melts down that deep. That's when they were still drilling. They had them wheely tanks, released one of the wheely tanks right overhead.

Interviewee #8: They can't tell me that all this water if protected. Even if it is ten thousand feet down, it's going to get up in our wells. Then what are we gonna do? They're not going to bring water to everybody.

Interviewee #9: Trucks may accidently have a fuel leak, a wreck, fuel spills. They've even documented the release of production water into tributaries. Clearly documented.

**Mineral Rights**

Interviewee #2: it all has to do with whether they own mineral rights or not. Every bit of it. [Laughs] There's a lot of jealousy among the natives, and among the new people too. We paid taxes all those years on mineral rights, and nobody was caring one way or another about that, until the benefits started coming here. [Laughs] Now it's a different story. And I didn't like paying all those taxes either, but we did because we didn't want to part with them. Wanted to keep them with the land. And some people divide them up, but I don't like dividing them up. I think who owns the land should own the mineral rights. And so we kept ours that way.

EM: How do you think it's effected relations between neighbors and family?
Interviewee #5: [Baby babbles] I believe it has, between the ones that do and don't own mineral rights. [baby babbles] Because, ninety percent of them that own mineral rights, they're from Georgia and everything else, don't know where they bought them. I've had that happen to me all of my life, so that don't bother me a bit. Some of the people that are even drawing the mineral rights don't like Chesapeake. So. That's because they eventually find out who they truly are. It's very obvious out here that if you're a mineral right holder, naturally you hold more power. So you do get treated a little better. But if you don't, then it's disrespect all the way around. 'Cause they know that the law's behind them all the way, laws and regulations. The surface owner, without the mineral rights, is powerless.
Interviewee #7: The oil boom that they had around here, these people didn't want to keep their mineral rights. That's one of the things that's wrong in this state right here. It matters who has their mineral rights.

EM: Do you own your mineral rights?
Interviewee #9: No. And I'm glad I don't.
EM: Why?
Interviewee #9: Then the gas company could buy them from me. Plus, then you don't have to make a critical decision. Especially for what I believe in. I don't want to have to choose money over what I believe in. So by not even having that ownership of the mineral rights, that's just another very large decision that i don't have to make.

Interviewee #11: The people that don't have their mineral rights are gonna be upset, to some extent, because I'm sitting here drawing royalties, they're sitting here listening to the same noise, the same traffic, and their drilling, and the same aggravation, their phone lines being torn out.

Natural Gas Lease

Interviewee #11: We're drawing a royalty so, they're tied up from eternity I guess. I would presume yeah.

Outside Workers

Interviewee #8: The worst of it is they don't wanna work here.

Interviewee #4: There's no respect for the people out here whatsoever. That's one of the biggest things is, these people come in from Texas, Oklahoma, they don't care about us. There's no respect.

Unfair Treatment

Interviewee #1: My wife sent to Chesepeake a list of expenses, out of pocket expenses, my wife had occurred because of Chesepeake, amounting to 2,000 dollars a year. Is that an unjust taking? In a legal sense? It's about 2,000 dollars a year that we were contributing to Chesepeake's business model. If for them to succeed in business, this resident had to pay 2,000 dollars extra a year and in lost time for the extra travel, and for vehicle wear and tear. Now is that being unjustly treated? Some people would say absolutely because they never reimburse people's expenses so is that unjust? Boy, it feels unjust. It's just the way large corporations can push their way into a rural community and not really take into consideration the costs of all the residents out there. We don't live
close to it. But my wife had to drive a half hour out of her way at the same time. Multiply that minor cost by all the other people who live there who daily have wear and tear on their vehicles. Sometimes real tear. Then you end up with a lot of people who would feel that they were unjustly treated. It's just I'm not focused on whether or not I feel that this is unjust.

EM: Do you feel as if you've at all been unfairly treated due to the natural gas activity in the area?
Interviewee: Yes. [Laughs] Where do we start?

EM: Do you feel as if you have at all been unfairly treated due to the gas development in the area?
Interviewee #9: Sometimes, I feel I've received that type of treatment from people I've known all my life. Especially when the things I'm trying to do, not only for the environment, but also for road safety, I mean, them and their family, children, whoever may be travelling on the roadways too. A lot of them don't agree with me, but do they ever stop and think of what I do to keep the roads safe, protecting their family as well?

Health Problems

Interviewee #5: Heather, Chris, my wife, all them get nosebleeds real bad after they started this fracking. And every time they start drilling, like over on the wellpad again, they're drilling and all that stuff's coming this way. They're getting nosebleeds and stuff, which I haven't got it yet, but I really feel bad and stuff. If you sit out here and breathe that stuff for an hour or two, you can't even come out and work hard without breathing. At night you can come outside, sit out by the lights out there, you just see all sorts of flakes and stuff. Particulates, floating through there. And then they tell you, oh no, there's nothing like that happening.

EM: Any medical problems?
Interviewee #6: Getting bald headed and everything. [Laughs]
Interviewee #5: [Laughs] That's pretty weird.
Interviewee #6: Breathing problems, and-
Interviewee #5: Everyone on the ridge here has started losing hair.
Interviewee #6: My whole body hurts.
Interviewee #5: Even the younger ones.
Interviewee #6: Sore throats. Congestion, and everything else, every day.
EM: Have you noticed more illness in the children?
Interviewee #6: Yes. [Crying]
EM: Like respiratory type illness?
Interviewee #5: Yeah, they got a cough and stuff right now, the two little ones. They're coughing and stuff. And they don't do it continuously, but every day you hear them coughing and stuff.
Interviewee #8: I'd say you'll probably see health problems twenty, thirty years down the road. Not now. Any time they come into a place-look at out West, all the people are sick now, and they've been out for years out there.

**Property Damage**

Interviewee #5: There's all these people leaving the gate open, which that's another problem I'm having. And I've called Chesapeake thousands of times on that, can you keep the gate closed and stuff? 'Cause had a goat out there tied up to a stake, horses got out and came out there and stomped my goat to death, killed it and everything else. And they don't care nothing about that. I told that guy out there, I said, something gets in here and hurts that pony, you dudes are going to be in court or something, because somebody's going to pay for that pony, that's my granddaughter's pony. And they're not going to get by with that one.

Interviewee #6: Got a house full of road dirt. A whole mess dug up by your house.

EM: Did you notice any economic benefits of the natural gas development?
Interviewee #7: Not to me I didn't. When they had water out here on the gravel part of the road-I got that stopped-I would drag it around under my truck, and it cost you money. We were dealing with the dust, then they created a bigger problem by trying to keep the dust down. The limestone turns to a cement. We were dealing with the dust before they came here, and we lived with it.

EM: Have you had any personal problems with them, for example coming into your yard and tearing it up?
Interviewee #7: When they first come out here they did. They were like four feet up on my yard.

Interviewee #7: It tears your vehicle up underneath. You're dragging this stuff around. You have to go get it cleaned, and that's money out of my pocket. It's not out of theirs, it's out of mine, because of what they're doing. Before this, maybe once or twice a year, I have to change the brakes on it. Three times a year now I have to change the brakes on it.

**Damage to Land**

EM: What about any environmental impacts, have you noticed?
Interviewee #7: Not really. Just the destruction of the property, you know what I mean? Tear the ground up to put the well pad on.

**Long-term Concerns**
Interviewee #1: I'm somewhat optimistic that we're going to be able to regulate as well as we can in the community, but by and large, as communities we don't do much until there's a serious problem. As a human race we tend not to have a lot of foresight. You wait until the house is burning then you think about fire extinguishers. You wait until the front wheel's squeaking like crazy before you worry about the wheel bearing right? So I'm not real optimistic we're going to have a lot of foresight [...] But this is not smart. This is inherently stupid. So we find smart and we develop a way that is going to accomplish the same ends, that is seamlessly and as cleanly with the minimal amount of impact. It's doable. So I'm slightly optimistic but I think we're gonna have to sometimes create some problems now and then to get better practices.

Gas Industry Lies

Interviewee #5: When they come in they told me that they would not be using no chemicals to frack with and all this and that stuff. And I was stupid enough to believe them before I knew better.

Interviewee #5: I don't know, these people they've lied to me, and lied to me, and lied to me. They told me they were drilling a new well and stuff when I got to bitching about the water. They went so far as to get a permit with Wetzel County to drill me a new well. And then they came to me one day and said, oh we're not doing nothing now. We're done. And then we were done. All this was based on verbal agreements. Give nothing without written permission. Make sure you get something in writing. And I'd even go so far as to have it notarized,' cause there's no way I'd take their word again.

Interviewee #5: I told him one day, he's a lying s.o.b.

Energy Independence/Environmentally Friendly Fuel

Interviewee #1: If you look at this from the macro, a lot of this is being sold as United States energy independence, which I don't think there's any truth to justify this activity. It doesn't mean you don't do it, it just means you need to be realistic with it. The companies who are supporting a lot of this activity like to see some other countries benefit as well by being able to buy gas at a higher rate than they can sell it here. So that would be energy independence for some other people. If you sell it as an alternate fuel, a bridge fuel, clean fuel, always has some truth to it, but it's also misleading because it's not the complete picture. I think the information we're told is being unrealistic about the total carbon footprint of natural gas. You have to go cradle to grave. The total amount of pollutions from the time you push dirt to the time you turn on the burner on your cookstove-what's happened between here, what's the total carbon footprint? What's the total amount of diesel fumes? If you look at the tens of thousands of gallons of diesel that
are being consumed on one well to get gas to my house, we have to account for that. That has taken a certain amount of petroleum products. So that means we've used more fuel. Where does that come from? Some of it comes from the tar sands. There's a lot of unknowns in this equation. We're doing a disservice if we simplify it. How much cleaner is it? There's the question. To say the truth, nobody knows. We never ask that question. It's a disadvantage because lulls people into a sense of this is all great, this is all wonderful. Yes, there's certain benefits to it.

EM: You said your background is a coal miner, do you feel extracting natural gas is a more environmentally friendly process?
Interviewee #11: They say it is. Truthfully, I don't know. They say it, but...I know burning's cleaner.

Interviewee #12: If they had a natural gas station here, we'd convert our car. I know all the state cars now run on natural gas.

Injury Due to Gas Development on Property

Interviewee #5: They put a culvert pipe out under the road out there, which I didn't know they had put that under there. And I was walking back from the house and I wasn't expecting it, but I fell on that and broke my wrist. And, I couldn't do nothing for six weeks then. It's just one thing after another. And they had run a pig through their gas line so it didn't get too much condensation and stuff in it. And I went down there, I was moving my granddaughter's pony one day, when they turned that thing loose-released the gas- and she took off, drove me down, bruised my legs from here down. It was really loud. They still do it over there once in a while, every time they do it I'm calling it in.

Water Withdrawal

EM: Do you think the gas companies here is protecting the environment?
Interviewee #7: I'm not much on the environmental end of it.
EM: What are you feelings about Glen Falls?
Interviewee #7: They fixed that. But they shouldn't have gone in there in the first place. The guy came out here thinking he could just run over the top of people. Chesapeake. They got rid of him because of that.

EM: You were discussing before about finding a creek completely dammed up for fracking water?
Interviewee #9: That's right. Not just once, a couple of times.
Environmental Justice Themes

Interviewee #10: My God, we haven't even broken the surface yet. [sighs] You know, there are numerous, numerous issues. I was thinking as I was driving over here, the word, if I say the word extraction, okay, people conjure up a painful dental process, probably. So, this is an extraction process. An extraction's painful. I don't care if it's coal, or it's oil, or it's natural gas. You know, there's a grizzly aspect to it. If it's not in your backyard, then you really don't know...you don't think about it. You know. You came up here burning oil today, where'd the oil come from? Was it tar sands in Alberta? Do they come from Kuwait, or Ethiopia? If you've watched anything about the oil gathering process in Ethiopia, I mean, it's just horrendous. Absolutely. So, there's a very grizzly aspect to energy extraction. And if you live in the middle of it, then you know what it is, and you know the pitfalls and the things that can happen. [...] that's the grizzly aspect and the Not In My Backyard aspect, are the major aspects. The whole boom and bust cycle of things, which, I mean, we're already seeing it here, where it's leveled off here. And, the gas guys are moving more into the Utica Shale [truck drives by]. The energy business, you know, it's just the way it goes, with boom and bust, and they change their focus and move on. So, there's....you know, one of the aspects the gas guys came in and said we're going to cure every problem we create and we build communities, and all that. And the fact is that they don't make a place a better place to live. You can't develop the Marcellus and not lose some wild and wonderful West Virginia. And they're not willing to say that, to admit to that. But that is the case. In our neighborhood here, just the fact that they have bought up some properties, we have fewer people, fewer residents here, then we did five years ago. So, are they good for the community? They paid premium dollars for those properties, and the people that sold those properties are happy. They were able to get out of a bad situation. But the fact is, there's fewer people here. So, what is the function of an area? Is it to produce energy, or is it to produce residents? They can't get the gas out of the ground without taking something from people. So, if you own no minerals, and you live on a gravel road, you're gonna suffer from the impact. And people will say, well, he or she's just disgruntled, 'cause he's not getting anything. Well, the fact is if you can't sit on your front porch, you can't hang your laundry out anymore, and you used to be able to do that, then something's taken from you. So there are inherent problems with the process. You know, there's the whole environmental aspect, there are never enough eyes to watch things. Not enough state eyes. And so, it really becomes dependent upon people who are willing to take pictures, to make phone calls, to keep an eye on things. So that it does get done in a reasonable manner.

Interviewee #10: The Wetzel County Action Group has studied the whole situation and...you know, we've really been ahead of the curve on the whole thing. And really pushed the envelope in West Virginia to get a Marcellus bill, which was disappointing, but it happened. You know, people with cameras and telephones, they made a difference.
Appendix D: Case Study Photographs

Case Study Photographs, Wetzel County, 8/13/2012-8/23/2012

Motel with no vacancy in New Martinsville. 8/13/2012

View of Ohio River from Hydro Park in New Martinsville. 8/13/2012
A resident fishes at Hydro Park in New Martinsville. 8/13/2012

Barn with drill rig in background. 8/14/2012
These residents no longer use their well water, and have to fill up this water tank weekly. A well pad is located on their property close to their home. 8/14/2012

Transporting bottled water at same residence. 8/14/2012
The same residents describe their rain as having a red color, possibly from iron deposits, as shown on the side of this water cooler. 8/14/2012

Natural gas industry truck passes by close to same residence. 8/14/2012
Natural gas industry trucks pass a well pad site. 8/14/2012

Passing a natural gas industry truck on a narrow road. 8/14/2012
Natural gas industry truck on narrow country road. 8/14/2012

Forest clearing at well pad site. This hillside has undergone remediation for erosion problems. 8/14/2012
Steep hillside beside well pad site. 8/14/2012

Deer beside well pad site. 8/14/2012
Small well pad site. 8/14/2012

Active drilling rig. 8/14/2012
Large trucks were observed driving past the center line of the road. 8/23/12

Unknown facility at Lewis Wetzel Wildlife Management Area. 8/23/2012
A natural gas industry truck kicks up dirt at Lewis Wetzel Wildlife Management Area. 8/23/2012

Plants on the side of the road are covered in dust and wilting. Lewis Wetzel Wildlife Management Area. 8/23/2012
Natural gas storage facility. 8/23/2012

Construction project near Lewis Wetzel Wildlife Management Area. 8/23/2012
Stone Energy waste pit. Lewis Wetzel Wildlife Management Area. 8/23/2012

Unknown storage tanks with “Danger” sign. Lewis Wetzel Wildlife Management Area. 8/23/2012
Unknown storage tanks with “Danger” sign. Lewis Wetzel Wildlife Management Area. 8/23/2012

Dry stream beside natural gas development activity. Lewis Wetzel Wildlife Management Area. 8/23/2012

Active natural gas well pad close to a home. 8/23/2012
Gas flare at same site. 8/23/2012

Energy company signs were observed around Victory Field. 8/23/2012