“IT ALL DEPENDS ON THE PRICE OF OIL!”: EAGLE FORD SHALE ECONOMIC DEVELOPMENT OUTOMES IN A BOOM-BUST MILIEU

A Thesis

by

TREY DANIEL-AARON MURPHY

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Chair of Committee,	Christian Brannstrom
Committee Members,	Michael Ewers
	James Mjelde
Head of Department,	David Cairns

May 2016

Major Subject: Geography

ABSTRACT

In October 2008, Petrohawk Energy drilled the first modern fracking well into the Eagle Ford Shale, sparking an oil and gas boom in what is now one of the world's most productive shale plays, responsible for 1.087 million barrels of oil per day. Large investments in production infrastructure and commercial developments have brought economic opportunities to one of the poorest areas in Texas. Notwithstanding multiple reports on economic activity, there have not been any studies examining how this development is experienced on the Eagle Ford Shale and the amount of local policymaker economic governance. I therefore ask: Does a resource curse exist on the Eagle Ford Shale? In framing this question, this study evaluates if social disruption and worsening economic inequality are present on the shale play. This thesis employs two methods: semi-structured interviews with 15 economic development officials from August 2014 to March 2015 and a spatial assessment of relative mineral wealth using 2010-2015 public tax data as a proxy for actual mineral wealth from Live Oak County, a core Eagle Ford oil and gas production county.

The interviews indicated that economic development officials are most concerned about the deterioration of roads, the high demand for housing, and ramifications of skyrocketing wages. Findings from the Live Oak County mineral wealth analysis demonstrate that only 1.95% remains local to the county. This absentee mineral wealth is concentrated with major energy firms in the Texas metropolitan regions. The implications from these results indicate that a traditional core-periphery relationship has

developed on the Eagle Ford Shale, economic development officials remain optimistic about development despite receiving few benefits in an apparent royalty paradox, and social relations are changing possibly due to absentee mineral ownership. I answer the research question by noting that there are indications that the resource curse is present. As one respondent describes it, Eagle Ford "[economic development] all depends on the price of oil!" and not on policymaker actions.

ACKNOWLEDGEMENTS

It is impossible for me to express my gratitude to my advisor, Christian Brannstrom. I would have never imagined that my study abroad to Costa Rica in 2011 would lead to a master's thesis on oil and gas development five years later. His mentorship at the undergraduate and graduate levels has been an important part of my scholarly development. I have hardly met someone with so much patience and generosity. I look forward to continuing our academic relationship into the future.

I would also like to thank Michael Ewers. I would have never started this project without his support. His knowledge of economic geography in extractive states provided important insight on the evolution of economic development in south Texas. Jim Mjelde's support has also been an important part of this thesis. I appreciate his perspectives on mineral firms and his help in framing the project.

I must also thank Matt Fry at the University of North Texas. While not officially a committee member, Dr. Fry has been an integral part of this research team. Many of the methods used in this thesis are derived Dr. Fry's research.

I would be remiss if I did not mention how much I appreciate Arnoldo Lima and Tom Loder. They filled those long rides to the Eagle Ford Shale with rich conversation as well as helped with some of the basic data processing. I also appreciate the Texas A&M Human-Environment Research Group, who offered great suggestions on earlier versions of certain sections.

My friends and family deserve appreciation for listening to my endless babbling about the Eagle Ford Shale. I must specifically thank my parents, who encouraged me to continue my academic studies and provided support to see me accomplish my goals.

Finally, I must thank my confidential interviewees in south Texas. Every respondent was very generous with his or her time. It is my sincere hope that the results of this thesis are in some way useful to the people of the Eagle Ford Shale.

This research was partially supported through National Science Foundation Grant #1262521.

NOMENCLATURE

API	American Petroleum Institute
CAD	County Appraisal District
CETRZ	County Energy Transportation Reinvestment Zones
CSV	Comma Separated Values
DIDO	Drive-in, Drive-out
EFSCDP	Eagle Ford Shale Community Development Program
EIA	Energy Information Administration
FIFO	Fly-in, Fly-out
GIS	Geographic Information System
HB	House Bill
IRB	Institutional Review Board
ISD	Independent School District
LDC	Long Distance Commuting
LNG	Liquefied Natural Gas
LOCAD	Live Oak County Appraisal District
Mcf	Thousand cubic feet
MMcf	Million Cubic Feet
RRC	Texas Railroad Commission
TLMA	Texas Land and Mineral Owners Association
TXDOT	Texas Department of Transportation

TXOGA	Texas Oil and Gas Association
TXT	Text File
URTEC	Unconventional Resources Technology Conference
UTSA	University of Texas at San Antonio
WTI	West Texas Intermediate

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

1. INTRODUCTION

1.1 Introduction

This thesis advances the knowledge and understanding of resource-extraction driven economic development practices in midst of a dynamic boomtown setting. As one stakeholder put it, economic development "depends on the price of oil!" (EFS004). This thesis explores some of the many intricate and subtle aspects associated with that argument: specifically, the range of stakeholder views and trends in the distribution of mineral wealth that sustains economic development. Some of the major findings from this research demonstrate that economic development officials are most concerned about the degradation of local roads, the unavailability of permanent housing concurrent with the over abundance of non-permanent housing, and the spike in wages leading to non-energy industry workforce failures. Furthermore, my research determined that mineral interests are largely held and owned by absentee firms and individuals. Therefore, the limitations in power and the size of their jurisdictions in comparison to the spatial breadth of the resource determine that municipal and county economic officials are only able to peripherally manage a few of the ramifications of the play. Based on the findings, this thesis demonstrates that there are indications that the resource curse is present through the social disruption of economic livelihoods and worsening economic inequality through concentrating mineral wealth.

Some findings of this thesis have already been shared with stakeholders through popular opinion pieces (Murphy 2015a, 2015b, 2016). I will also share more results with study participants in 2016. The information gained from this research has already been

leveraged into lessons on boomtown development in Planet Earth Laboratory (Geography 213), Economic Geography (Geography 304), and the Geography of Energy (Geography 309).

This section outlines the study area and states the research question as "does a resource curse exist on the Eagle Ford Shale?" I also outline the two main research objectives of this thesis. Section 2 reviews the literature, providing a foundation for the research. Section 3 describes the methods used in this thesis, while Sections 4 and 5 examine economic development stakeholder views and an analysis of public county tax appraisal data; Sections 6 and 7 return to the literature, providing context for the findings and offering some concluding thoughts.

1.2 The Preconditions for the Eagle Ford

In October 2008, Petrohawk Energy—now a subsidiary of BHP Billiton—drilled the first two exploration wells, STS-241 #1H and Dora Martin #1H, into the Eagle Ford Shale in La Salle County, Texas, to little fanfare. The Eagle Ford is an oil and gas bearing shale deposit that stretches in a crescent from Laredo to Madisonville, Texas, and had been recognized by geologists since the 1950s. The depth and materiality of the formation (tight shale) precluded any development of the play—an industry term that entered into the popular lexicon to refer to an area of oil and gas exploration. Despite the significant advancements in hydraulic fracturing (hereafter "fracking") techniques on the Barnett Shale in North Texas, few companies recognized the opportunities in south Texas. Nevertheless, throughout 2008 Petrohawk mobilized assets from east Texas basin

to south Texas to start construction on the first wells into the Eagle Ford Shale (Francis 2008; Durham 2010). Previous forays into the area had been quite profitable, as companies had invested in the shallower Austin Chalk formation in the 1970s-1990s (Pearson 2012). Notwithstanding the strong positive returns from these first wells in both monetary and hydrocarbon terms, few were aware of the company's discovery. Geologists both at Petrohawk and in other hydrocarbon firms were quick to downplay the possible profitability of the Eagle Ford Shale (Francis 2008; Durham 2010). Few energy experts would have imagined that this these wells would spark the largest (by some accounts) present-day oil play in the U.S. only in the course of six years (EIA 2015c).

Touted to bring energy independence by policymakers to a country that had been importing increasingly greater volumes of oil since the 1970s, late 20th and early 21st century advancements in shale hydrocarbon extraction techniques offer rejuvenation to American regions that had been in severe decline due to rural-to-urban migration (Lave and Lutz 2014). Associated with tar sands and coalbed methane under the term "unconventional hydrocarbons," shale oil and gas exploration has been lauded as a potential source for U.S. energy independence (Chew 2014). The political, environmental, and economic consequences of shale plays have been manifest across the U.S., where these techniques are now coaxing unprecedented amounts of hydrocarbons from deposits that were deemed unattainable as few as twenty years ago. Some of the most active plays are found in the Northeast (Marcellus and Haynesville shales), North Dakota (Bakken Shale) and Texas (Barnett, Permian, and Eagle Ford shales) with many

lesser-explored deposits scattered across the United States and beyond. Each shale deposit has a unique combination of oil and gas available to producers, with some formations more associated with oil exploration (Bakken and Permian) while others with gas (Barnett and Marcellus).

Hydraulic fracturing, perfected on the Barnett Shale near the Dallas-Fort Worth Metroplex, is the most significant innovation leading to the boom in oil and gas exploration. Fracking uses a combination of water, sand, and chemical lubricants injected under high-pressure to pry open deep subsurface deposits. The oil and gas then returns to the surface where it is harnessed and transported via pipelines, semi-trucks, or trains. Since 2008, because of sustained levels of lowered natural gas prices, firms have been selectively targeting oil deposits while any associated natural gas is usually flared at the well site.

Shale, while expansive in land area, is generally relatively thin, with many deposits only a few hundred feet thick. As a reference, the western part of the lower Eagle Ford Shale is up to 600 feet thick, while the eastern part of the play averages about 100 feet (EIA 2014). Oil and gas producers surmounted this problem by horizontally drilling into the shale play. As the drill bit is lowered into the well, it turns at slight angles so that the bit is traveling laterally through the deposit. This enables a single well to tap into thousands of horizontal feet of the play. Furthermore, since there is no competition for the resources directly below the well, the exploration firm can drill multiple wells from the same five to ten acre pad site. Some locations are comprised of 20 or more wells extending radially. The term “fracking” collectively describes

hydraulic fracturing, horizontal drilling, and improved pre-drilling technologies (i.e., three dimensional seismic testing) (Martineau 2007).

1.3 The Eagle Ford Shale

The Eagle Ford Shale, an oil and gas bearing shale deposit that extends in a crescent from the Río Grande north of Laredo to the I-45 corridor near Madisonville, Texas (Figure 1), provides the focus of the study. Many areas along the Eagle Ford have previously experienced hydrocarbon exploration, with several wells dating back to the 1930s (Pope and Handren 1992). Indeed, there are particular regions of the Eagle Ford that have previously experienced the throes of oil-related price volatility, such as the Pearsall and Giddings plays on the Austin Chalk—an oil bearing formation above the Eagle Ford Shale. One particular seven-county region in Central Texas gained international notoriety when major oil companies began to explore the Austin Chalk in the late 1970s and early 1980s. This led to shortages in housing and civic services as the county was transformed from one of the 10 poorest in Texas to one of the richest in a few years (Hurt III 1981; Pirtle 2011). However, there were no assurances that the boom would last. In fact, a 1981 *Texas Monthly* article questioned whether the Giddings play would be "the last boom" because of the disappearance of the wildcatter—independent oilmen who are more likely to gamble on marginal or potential plays—and the belief that all the major U.S. onshore oil fields had been discovered and exploited (Hurt III 1981).

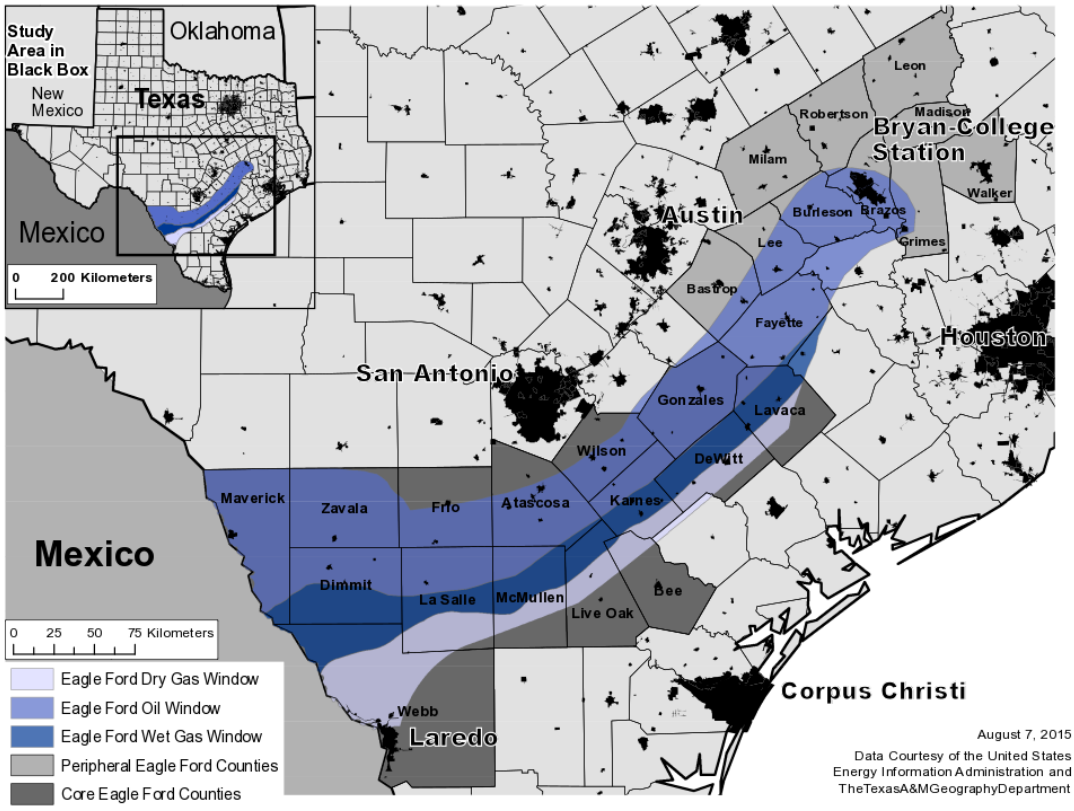

Figure 1: Map of the Eagle Ford Shale (EIA 2013).

Expanding from two wells in October 2008, drilling activity in the Eagle Ford Shale (as of December 2015) includes 9,887 completed oil wells, 4,835 gas wells, with another 4,800 wells permitted for eventual drilling (Railroad Commission 2015a). Oil production has ballooned to 1.087 million (11.6% of total U.S. production), while natural gas production has risen 5,348 million cubic feet (MMcf) per day. Furthermore, 275,939 barrels of natural gas condensates (Railroad Commission 2015a)—a liquefied hydrocarbon that exists in a state between natural gas and crude oil—are produced daily. Condensates require minimal field processing to be turned into diesel, kerosene, and

naphtha. Moreover, condensates can be exported without congressional sanctioning (Sider 2014) and, as a result, were sought by the oil and gas industry, especially prior to the lifting of the U.S. export ban in December 2015. Petroleum firms target a subsection of the Eagle Ford Shale, the Lower Eagle Ford Shale, which is found between 3,000 and 13,000 feet below the surface depending on the location of the well.

Across the 21 counties that make up the play, the Eagle Ford provides "over $87 billion in economic output" and supports 155,000 full-time equivalent jobs (Tunstall et al. 2014, 5). Reminiscent of Gilmore's (1976) hypothetical town, Pistol Shot, small communities across the Eagle Ford—once isolated geographically and metaphorically—are now intricately linked into the global economy. Although the Eagle Ford Shale is the primary target of present-day drilling, south Texas is host to several other unconventional plays, not the least of which are the Pearsall Shale, Eaglebine, and Olmos Sand; however, the economic viability of these plays is unknown. Energy companies are evaluating theses plays, with some having already drilled exploration wells into them. In media reports, these shale plays are undifferentiated and grouped into the Eagle Ford Shale.

1.4 Research Question and Objectives

Despite the importance of petroleum-based energy exploration to the future of the U.S. energy and development landscape, geographers and other social scientists have so far failed to critically examine the economic development shocks of shale (Willow and Wylie 2014; Calvert 2015). Furthermore, very few shale energy studies engage with the

spatial distribution of energy geography phenomena and instead treat the region as a whole (Pasqualetti and Brown 2014). Rather, broad generalizations about entire regions or countries cloud local realities. This offers an opportunity for geographers to engage with the "local" and learn how these processes are registering with individuals differentially across a play. In these circumstances, I offer two approaches to explore local economic development drivers: semi structured interviews with key economic actors and the distribution of one Eagle Ford county's mineral wealth.

Research Question: Does a resource curse exist on the Eagle Ford Shale?

Tunstall (2015b) notes that the resource curse is not occurring based on an increase in per capita income from 2008 to 2011. However, the resource curse has other parameters, such as the Dutch Disease (Neary and Van Wijnbergen 1986), lowered investment in human capital and the degradation of the physical environment (Gylfason 2001). This thesis evaluates social disruption (Gilmore 1976; Haslam Mckenzie 2013) and decreasing economic equality (Sarraf and Jiwanji 2001) as indicators of an Eagle Ford Shale resource curse. For a full description of the resource curse, refer to Section 2.2.

Objective 1: Discover economic development narratives for energy development. Using a semi-structured interview and coding protocol established in Section 3, I assess the views of 15 local economic development officials (municipal and county government officials, economic development corporation administrators, chambers of commerce

presidents and governing bodies) regarding the arrival of oil and gas development. I was able to capture their responses to plummeting hydrocarbon prices and examine the main ramifications to energy-spurred growth in the midst of boomtown conditions in a place-based context. The approach is based in a boomtown development literature grounded in Gilmore's (1976) problem triangle. These data are presented in Section 4 and discussed in Section 6.

The seminal modern publication on boomtown development, John Gilmore's 1976 *Science* article, offered a glimpse into economic development in a boomtown-milieu. Gilmore noted the four major stages of boomtown development—enthusiasm, uncertainty, panic, and acceptance—before offering solutions for improved boomtown economic and social development. This aspect of his research has been thoroughly examined by the literature, and for the most part, tacitly accepted. He also proposed the "problem triangle," which the boomtown scholarship has yet to critically engage. In this conceptualization of the major issues of boomtown development, Gilmore noted that degraded quality of life from energy development leads to an unstable labor force that causes declining industrial output. This, in turn, causes tax expenditures to decrease forcing lowered tax revenues and investment. Finally, these decreased local services further decrease the quality of life—a feedback loop. As part of this thesis, I will revisit the problem triangle and reconcile it to the modern materiality of oil extraction. I will then place it into a conversation on the resource curse.

Objective 2: Determine the spatial distribution of relative mineral wealth in Live Oak County, Texas. Using publically available data, I map and assess the spatial variability of mineral interest holdings in the Live Oak County Appraisal District as a proxy for mineral wealth. Live Oak County is a key oil and condensate producer in the Eagle Ford, with 752 wells drilled as of the end of 2015. I also determine the main beneficiaries of the wealth. The methods are presented in Section 3, then the results are offered in Section 5.

In Section 6, I interpret the quantitative results and demonstrate how they diverge from the economic development narratives offered by economic development stakeholders on mineral ownership, who believe that "everyone wants an oil well in their backyard." I examine the similarities and divergences between the results of this study and other economic development studies of the Eagle Ford Shale and in other shale plays. I not only critique previous economic impact studies of energy development, but also offer political economy reasoning for why Texas has seen increased support for State legislation that decreases the power of local fracking governance. Energy firms prefer regulatory guidelines at the state level rather than municipal. As Davis and Hoffer (2012) note, this is largely driven by four factors: 1) firms can focus lobbying efforts on the hydrocarbon regulatory body; 2) state legislators are more accessible and easily swayed by industry discourse due to the smaller constituencies; 3) industry-advocates use their positions to demonstrate business transparency and describe economic benefits at a local level; and 4) industry officials are able to demonstrate that they can abide by state regulations. While Davis and Hoffer (2012) support why fracking regulations have

been largely absent from federal intervention, they fail to answer why industry and mineral interest holders are equally opposed to municipal or county regulations. This study will offer a hypothesis as to why mineral holders and owners are averse to local fracking regulations. To conclude Section 6, I will provide an answer to my research question.

1.5 Previous Social Science Eagle Ford Shale Studies

This study analyzes how the Eagle Ford Shale is influencing economic development outcomes using local stakeholder narratives and public tax appraisal data as a way to query whether elements of the resource curse are present. This project adds to a small yet burgeoning literature on the societal externalities of resource development on the Eagle Ford Shale. Johnston, Werder, and Sebastian (2016) note how saltwater disposal wells on the Eagle Ford Shale are statistically more likely to be sited in locations that have a higher percentage of people of color. This creates a potential environmental injustice. Schade and Roest (2015) examine how the flaring of natural gas on the Eagle Ford is contributing to poor air quality in San Antonio. Besides air pollution, local governments have been witness to the energy industry traffic on country roads incapable of handling the loads (Rahm et al. 2015), with each well causing $133,000 in damage over the life of the well (Naismith Engineering, Inc. 2015) and resulting in decreased pavement conditions (Quiroga et al. 2015), as well as an increase in the number of commercial vehicle crashes that are frequently fatal (Quiroga and Tsapakis 2015).

A group of University of Texas at San Antonio (UTSA) researchers have assessed the Eagle Ford Shale as a $87 billion boost to the Texas economy resulting in 155,000 full time equivalent jobs as of 2013 (Tunstall et al. 2014). Further economic evidence suggests that the Eagle Ford Shale has, so far, avoided decreasing per capita incomes, one of the tenants of the resources curse (Tunstall 2015a, 2015b); however it is still too early in the development period to draw such a significant conclusion. Brown, Fitzgerald, and Weber (2015) estimated that 24.5% of Eagle Ford royalty owners were local to the shale play. The average royalty rate was 20.3%, which generates $2.83 billion in local royalty income and $11.54 billion in total (local and nonlocal) royalties. Moreover, they determined an average in-county ownership for mineral properties in Texas to be 21.7%. This group of Eagle Ford economic studies will be scrutinized in greater detail in Sections 2, 4, 5, and 6.

1.6 Conclusion

This investigation contests the assertion that south Texas oil and gas development has *not* led to the resource curse. Rather, I demonstrate that economic inequality is increasing and social disruptions are negatively influencing quality of life in south Texas. Therefore, there are indications that elements of the resource curse are present. I also illustrate the differences between views held by economic development officials and quantitative data on mineral ownership. I shed light on the development decisions that stakeholders must consider when presented with a resource extraction situation. I critique oil and gas economic impact studies that fail to examine the spatial variability of

hydrocarbon wealth and ownership and offer an interpretation for why energy firms prefer state-level scalar politics as opposed to local politics. I conclude this thesis by summarizing my arguments and suggesting avenues for future research.

2. LITERATURE REVIEW

2.1 Introduction

This section explores the main literatures to which the thesis makes contributions. I will survey and provide commentary on the regional development of extractive resource economies through quantitative and qualitative perspectives. This is accomplished by examining the resource curse and the staple economy. Next, I will describe the literature on boomtowns, tracing its evolution from the 1970s to present. I will note who is responsible for the development of economic policies in extraction environments. I will also query economic impact studies that involve mineral wealth. This leads to a discussion of the split estate and ownership of minerals. These descriptive and economic studies will then be linked to political economy analyses of resources that connect the energy industry and economic and political outcomes in Texas. Throughout this section, I will situate the various literatures to the resource curse and the objectives of this research.

2.2 Regional Development in Extractive Economies

Oil and gas extraction provides opportunities for rapid regional development, but resource-driven economic growth is associated with detrimental economic and institutional outcomes termed the "resource curse" (Auty 1993; Sachs and Warner 1995, 2001; Davis 2010). Social scientists have proposed many, mechanisms through which resource abundance distorts the development process (Frankel 2010; Torres, Afonso, and Soares 2013), however this thesis summarizes its mechanisms as: 1) the emergence of

the Dutch Disease, whereby resource sector exports increase a country's monetary value which crowds out investment and entrepreneurship in less competitive infant industries (Neary and Van Wijnbergen 1986; Auty 2001; Gylfason 2001; Rodrik, Subramanian, and Trebbi 2004; Michaels 2011); 2) resource extraction degrades the physical environment deterring potential post-extraction growth (Gylfason 2001; Sachs and Warner 2001; Michaels 2011); 3) competition for resource windfalls promotes rent-seeking and corruption, distorting the formation of social capital institutions (Ross 1999; Auty 2001; Torvik 2002; Isham et al. 2005; Humphreys, Sachs, and Stiglitz 2007; Kolstad and Wiig 2009; Michaels 2011); 4) rent seeking behavior causes decreasing per capita incomes (Torvik 2002); 5) worsening economic inequality (Sarraf and Jiwanji 2001); and finally, 6) the influx of investment into a region causes a disruption to the local societal fabric (Gilmore 1976; Haslam Mckenzie 2013). As discussed in Section 1, this thesis will focus on the latter two: worsening economic inequality and social disruption. While not every resource-based economy experiences the ramifications of the curse (see Larsen 2006), without strong institutional oversight a country's economic and social stability is largely tied to commodity prices (Ewers 2015).

Manifestations of the resource curse can occur at different scales. For example, Chilean regional economies have been linked to the pricing of copper and the crowding out of higher-ordered economic activity (Barton, Gwynne, and Murray 2008; Rehner, Baeza, and Barton 2014). This could lead to potential economic stagnation if copper prices become negatively volatile. Closer to the study area, the historical rise of oil production in the U.S. South led to a displacement of agricultural jobs in favor of

hydrocarbon exploration and refining (Michaels 2011). Tunstall (2015a) suggests that the Eagle Ford could be experiencing the Dutch Disease due to the nature of south Texas institutions, yet his 2008-2011 income-based analysis noted that the resource curse was *not* taking place (Tunstall 2015b). These "internal peripheries" may be more exposed to resource curse ramifications than entire countries (Bridge 2008, 393). Weber (2014), based on his examination of the south-central U.S., notes that the resource curse is absent. He substantiates this argument by discussing that there were 1.4 jobs created for every resource job and that education attainment levels in the region had increased. However, resource curse hypotheses have been under-examined in new American energy geographies (Calvert 2015), one of the aims of this research. This is especially important as some U.S. resource extraction studies find the ramifications of the resource curse already present (Papyrakis and Gerlagh 2007; James and Aadland 2011).

Inspired by the work of Innis (1929), who examined Canada's economic ascendance and dependency through the lens of natural resource extraction, many geographers have engaged with the ideas of institutionally-based resource development. Canadian researchers have expanded resource-based institutional development by offering a strong challenger against the purely quantitative models (Hayter, Barnes, and Bradshaw 2003). Universal quantitative models are incognizant of the geographically- and historically-specific experiences of economic development found in resource supply regions (Barnes and Hayter 2005). Staple economies are subject to a volatile lifecycle, in which regions attract extraction companies for employment and development purposes. These large firms are dependent on factors (usually) exogenous to the region, such as

commodity pricing and the lack of institutional oversight (Barnes, Hayter, and Hay 2001). Inspired by this work, other investigators have examined regional institutional influences. For example, other research has suggested that without historical institutions guiding Californian resource development, the state would not be as prosperous as it is today (Walker 2001).

2.3 Reimagining the Boomtown

Despite the limited cross-pollination between the resource curse literature—usually examined at a regional level—and the site-specific boomtown literature, this thesis offers findings in both. Indeed, one component of the resource curse, social disruption (Haslam Mckenzie 2013), was original to the boomtown literature (Gilmore 1976). The spatial nature of resource extraction—with some areas better suited for exploration due to their surface and subsurface situation—inherently creates an uneven spatial landscape of mineral exploration. Therefore, cities, and not necessarily regions, are the sites of experiential economic failure and success. Boomtowns emerge in locations that are spatially proximal to the rapid development of high demand commodities, with their site-specific characteristics dictating the experience of mineral extraction. Aspects that contribute to a town's relationship with mineral extraction explored in this thesis are the nature of mineral ownership, the availability of workers, the quantity and characteristics of accommodations, and the carrying capacity of preexisting infrastructure needed to transport products and employees to and from drill sites. While energy companies can centralize many aspects of production to distant

company headquarters (e.g., finance, human resources, legal expertise), firms must interact with boomtowns through the many aspects of mineral production that require *in-situ* performances (e.g. mineral contracts signatures, the drilling of the well, logistics). Often, these towns are associated with higher levels of individual stress, deteriorating feelings of social cohesiveness, increased social issues, and greater labor turnover (Kassover 1981). Many boomtowns fail to materialize in the ways expected. Researchers find that boomtowns respond (e.g., socio-economic changes) to the resource economy based on site-specific characteristics such as "their commodity base, location and socio-demographic structure" (Lawrie, Tonts, and Plummer 2011, 160). While applicable to shale exploration, the boomtown literature base has been criticized for failing to capture local, place-based eccentricities (Nord and Luloff 1993; Tonts, Plummer, and Lawrie 2012; Jacquet 2014). This study addresses this gap by examining the place-specific factors that lead to positive or negative boomtown economic development outcomes.

Gilmore (1976) provided one of the foundational modern scientific accounts of the boomtowns. The author traced the devolution of a fictionalized town, Pistol Shot, as it is overwhelmed by nearby resource development. Gilmore noted that most boomtowns experience four phases of development: 1) enthusiasm for the possibilities of economic growth; 2) uncertainty reflecting concern about missed development goals and as the reality of resource extraction descends on the city; 3) panic emerges as citizens find themselves unable to cope with the changes; and 4) adaptation to the major ramifications of resource extraction (see also Brasier et al. 2011). These four stages of development

have been accepted, adapted, and reinterpreted (Gramling and Brabant 1986; Ennis, Tofa, and Finlayson 2014; Cope et al. 2015).

Additionally, Gilmore proposed a "problem triangle" that illustrated the main issues boomtowns encounter (Figure 2). The boom in population caused by the discovery of resources causes degraded quality of life, which makes it difficult to attract labor to the region. This, in turn, decreases productivity, causing a disruption of local services leading to decreased quality of life. This feedback loop, Gilmore contended, endures until a stasis or retrenchment of resource extraction. Interestingly, despite offering a more rigorous theoretical approach than his four phases of development, the triangle has received little attention from the boomtown scholarship scholars. Wilkinson et al. (1982), suggesting that resource extraction could be positive for a community, ignored the problem triangle but provided a scathing critique of the social disruption hypothesis advanced by Gilmore. He instead insisted that more quantitative research should be conducted to assess whether municipalities are negatively impacted by resource development. By the end of the decade, investigators noted that boomtowns likely lie somewhere between the two extremes (Rosa, Machlis, and Keating 1988). While social scientists continue to mention the problem triangle in broad-stroke examinations of boomtowns (Jacquet 2009, 2014; Schafft, Borlu, and Glenna 2013), they have not critically engaged with the triangle itself. In this thesis, I advance this literature by revisiting the problem triangle and reconciling it to the modern materiality of oil extraction.

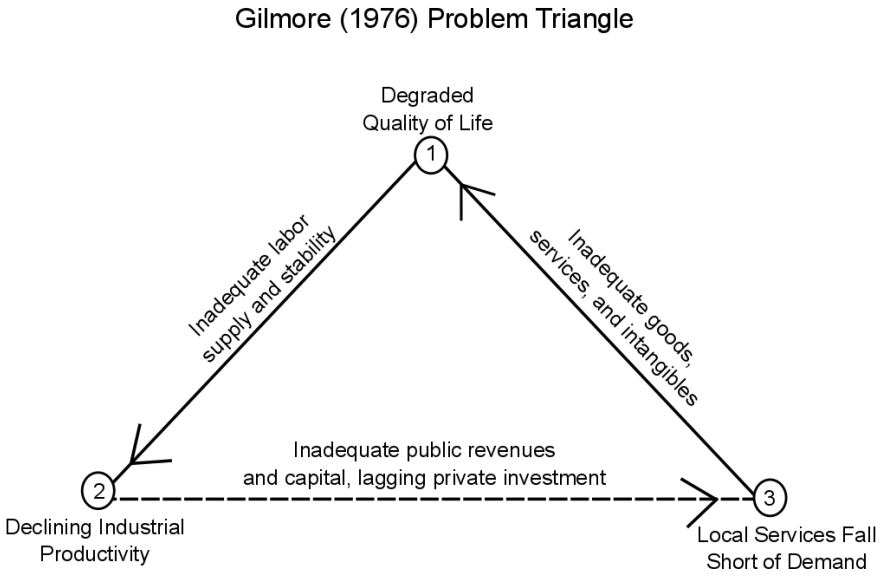

Figure 2: Gilmore's (1976, 191) Problem Triangle (Redrawn with permission from the American Academy of Scientists).

Resource extraction leading to boomtown development disrupts municipal social and civic services (Gilmore 1976; England and Albrecht 1984; Weber, Geigle, and Barkdull 2014). This disruption to the social fabric occurs prior to the drilling of the first well (Brown, Geetsen, and Krannich 1989; Simonelli 2014; Crowe et al. 2015) and can persist for years after the completion of the final well; however, this disruption is not permanent (Smith, Krannich, and Hunter 2001). While boomtowns bust when commodity prices drop and activity retrenches, evidence suggests that after a decade the city eventually recovers to a state improved from the pre-boom conditions (Brown, Dorins, and Krannich 2005) provided that governance actors take action to help mitigate the negative economic development shock(s) using positive shocks (Besser, Recker, and

Agnitsch 2008). The literature further suggests that long-term production in oil and gas can have positive economic benefits, even if the immediate response is negative. Weber (2012) notes that income and population increases are correlated with petroleum extraction in Wyoming and Colorado; however, the longer a region stays specialized in oil and gas, the smaller the impact to income (Haggerty et al. 2014).

The boomtown literature associated with the explosion of activity since 1999 in the U.S. has only started to materialize. Several studies have focused on the agency dynamics surrounding oil and gas development in the Barnett Shale, which supported economic development in North Texas. Indeed, locations experiencing energy extraction for a longer period of time are more likely to notice the consequences of energy extraction (Theodori 2012). This is especially important given that residents and government officials are aware of energy extraction's social and environmental costs and yet still believe that it provides economic development potential (Anderson and Theodori 2009; Wynveen 2011; Theodori 2012). Additionally, the stakeholders interviewed in the Barnett Shale studies—city employees, county government officials, economic development leaders, and chambers of commerce personnel—mirrors this thesis (Anderson and Theodori 2009).

Similar results were found on the New Albany Shale—a largely undeveloped play—where political leaders were excited by the economic opportunities of shale development (Silva and Crowe 2015). This excitement did not translate to the citizens, where residents were more skeptical of shale energy development, indicating a gap in perception between residents and local policymakers (Crowe et al. 2015). Brasier et al.

(2011) goes on to reiterate that, just as on the Barnett Shale demonstrated by Anderson and Theodori (2009), the perceived benefits and consequences associated with fracking are spatially diverse across the Marcellus Shale, which was similarly confirmed on the border between Pennsylvania and New York (Stedman et al. 2012). These spatial differences result from population size, proximity to metropolitan centers, amount of preexisting infrastructure development, and the history of extraction (Brasier et al. 2011, 2013).

Human capital acquisition and retrenchment in a boomtown follow a similar pattern among resource economies. First, exponential growth in the labor market occurs, followed by eventual cost cutting as exploration turns into production. The labor market then operates at an elevated labor supplied-demand equilibrium until resource exhaustion or new deposits are found (Lucas 1971). These patterns have become much more pronounced with the reliance on the service industry to operate mining activities—which allows for greater acquisition of technological improvements and greater responsiveness to market activity—and through fly-in, fly-out (FIFO) or drive-in, drive-out (DIDO) arrangements, which only temporarily places workers in the resource region (Tonts 2010; Keough 2015). This type of worker-firm arrangement limits worker-community integration and paralyzes sustainable municipal development (Storey 2001). In Australia, these DIDO/FIFO arrangements largely appear in response to inadequate housing in mining regions, with confounding factors such as the location of the company headquarters and the firm's institutional culture ultimately forcing employees to live hundreds or thousands of miles away from the jobsite. This form of employment is

averse for both the city that houses the workers, where social problems tend to emerge, and the municipalities that host the workers on a short-term basis (Storey 2001; Perry and Rowe 2015). Long distance commuting (LDC) causes a significant leakage of income to regions beyond the host region. In Chile, for example, LDC benefited the sending city (in that case, the major metropolitan regions), while the towns temporarily hosting the workers were disadvantaged (Aroca and Atienza 2011). While the former is certainly a relevant concern, the present research examines the latter, in which small municipalities on the Eagle Ford have become temporary hubs for short-term worker housing (Section 4).

Freudenburg and Gramling (1998) studied how oil company linkages emerged in Louisiana from the late 1950s to the early 1990s. They note that linkages (which inherently lead to economic embeddedness) only developed after several decades of profitable oil exploration and production. Following a severe drop in oil prices, these linkages quickly dissolved (often more quickly than the extractive sector itself) resulting in a flight of qualified human capital from southern Louisiana to other regions. Therefore, the social linkages between an extraction firm and a boomtown are superficial, except in those cases where energy production can be established for a long period. This concept will be explored more extensively later in the thesis.

2.4 Mineral Interests[1], Economic Impact Studies, and the Resource Curse

While qualitative social scientists continue to grapple with resource development on boomtowns, economists have estimated the economic impact in resource regions (Jacquet 2009; Kinnaman 2011; Tunstall 2015a). These studies are useful because they provide citizens with simple outcomes in monetary terms; however, comparable to the resource curse and boomtown literature discussed earlier, the spatiality of mineral wealth across the play—the material basis for economic development—is not examined. While economic impact studies frame development in a state-specific or region-specific context, the effects of rapid resource development are locally experienced, because oil and gas extraction relies upon worker housing and amenities, dialogue between firms and surface owners, and numerous logistical operations. Therefore, this section emphasizes the gap between regional mineral wealth studies and the methodology this thesis employs.

The discursive understanding of oil and gas geographies has been developed mainly in regard to contexts where the state owns resources and allocates access to firms through contracts monitored and enforced through bureaucratic procedures, often highly opaque and subject to rent-seeking activity. Determining access and distribution of

---

[1] Throughout this thesis, I use "mineral interest" to refer to the total mineral property (the mineral estate) and all the associated contractual interests associated with it unless otherwise stated. The "royalty," on the other hand, is the negotiated percentage that the mineral property owner(s) receive(s) from the vending of the extracted oil and gas through a mineral lease. While there are two types of royalties used in this thesis, personal royalties and overriding royalties, I am careful to make a distinction between the two whenever possible. A full description of the various forms of mineral interests will be presented in Section 3.

wealth has been key research focus, for example, in the Andes relating to hydrocarbons, hard-rock and alluvial mining (Perreault 2006, 2013; Bebbington and Bury 2009). In the U.S., however, the study of oil and gas mineral wealth is limited to analysis of royalty data, oftentimes in a regional context. These royalty studies are frequently part of broader economic impact analyses (Kinnaman 2011). There are a few investigations that have focused on the ownership of mineral wealth, such as one that examined the impact of mineral royalties on the economies of six shale production regions using a proprietary software package (Brown, Fitzgerald, and Weber 2015). This study found that the shale plays generated $39 billion in 2014 in private royalties. Another from Denton, Texas, found that local residents are subject to environmental injustice because of the lack of local mineral ownership and the nature of Texas mineral tenure laws (Fry, Briggle, and Kincaid 2015). While some studies have been conducted of entire regions (Weber, Brown, and Pender 2013; Brown, Fitzgerald, and Weber 2015) or of a single municipality (Fry, Briggle, and Kincaid 2015), analysis of an entire *county's* mineral wealth distribution has not been conducted, one aim of the present research.

The mapping of mineral interests and royalty income has been a major topic amongst developing world political ecologists (Bebbington and Bury 2009; Orta-Martínez and Finer 2010; Bury and Bebbington 2013; Cuba et al. 2014; Finer et al. 2015). Tracking the distribution of mineral wealth in these situations is relatively simple given that frequently the state owns the subterranean resources (all the wealth flows to a single entity and the firms developing the resource). In the U.S., however, all states allow for mineral (subsurface) estates to be severed from the surface properties,

commonly referred to as split estates (Collins and Nkansah 2015). The subsurface property owner then has the right to develop or lease the property for development; furthermore, the owner can receive bonus, rental, or royalty payments (Theriot 2012). Texas law, established in *Grimes v. Goodman Drilling Company* (1919), grants supremacy to the mineral estate, because failing to do so would drastically reduce the value of the mineral property should development opportunities arise (Gold 2014, 20–23). Surface property owners have limited say over the placement of extraction infrastructure once development starts.

Because split estates are used in the U.S., conflict between severed surface and mineral properties looms if the development of the mineral estate damages the surface estate. This especially important in low-income locations, where the surface low-income property owners or lessees typically do not have an interest in the mineral estate (Willow and Wylie 2014). This doctrine is even more relevant given the potential environmental justice ramifications to surface estate owners from drilling (Fry, Briggle, and Kincaid 2015; Johnston, Werder, and Sebastian 2016). Indeed, even in situations of complete mineral and property ownership, social unease can develop because of differing royalty percentages offered to mineral owners. Based on the context of the well and contract negotiations, mineral owners can receive differing royalty percentages (Willow and Wylie 2014). This anxiety is exacerbated by reports of oil and gas firms turning neighbors against one another for profiteering purposes (Sawyer 2004; Willow and Wylie 2014).

This sentiment was reinforced by Weber, Brown, and Pender (2013), who understood that "the uneven distribution of costs and benefits could cause tensions between neighbors as some work ardently to limit energy development while others welcome it" (22). Moreover, despite royalties creating wealth (largely through increased property values) for many mineral holders, there is a small amount of economic change. For every $1 in royalty payment, $0.042 of consumption takes place, and this only occurs if a single owner wholly owned the mineral estate. Royalty information drawn from a public survey estimated that 3.4% of all farms receive royalty payments for any form of energy development (renewable or nonrenewable sources) (Weber, Brown, and Pender 2013).

Attempts to determine the nature of royalties on the Marcellus Shale have been meager. Kay (2011) noted that the "extent of severed rights in particular is very difficult to estimate empirically because of the lack of easily accessible records" (14). To circumvent this issue, other researchers have used local versus absentee *surface* property ownership as a proxy for mineral tenure, estimating that 7.7% of owners lived out of state (Kelsey et al. 2011). While there is some overlap in the nature of tenure between the surface and subsurface, other methods and data explored in this thesis are able to better capture the spatial nature of mineral ownership.

Fry, Briggle, and Kincaid (2015) used mineral tax appraisal data to assess the amount of local Denton, Texas, mineral ownership. Individual owners accounted for less than 1% of total mineral interest, with the City of Denton being the largest beneficiary of royalties (approximately 1.6% of total mineral interest). However, the authors only

examined royalties and not working, overriding, or any other well lease interest. These other interests account for 83.7% of the total mineral interest (Fry, Briggle, and Kincaid 2015).

Closer to the study site, Brown, Fitzgerald, and Weber (2015) estimated that 24.5% of Eagle Ford royalty owners were local to the play. The average royalty rate was 20.3%, generating $2.83 billion in local royalty income and $11.54 billion in total (local and nonlocal) royalties. Furthermore, they determined an average in-county ownership for mineral properties in Texas to be 21.7%. Again, the authors only focused on royalties. These data were based on information acquired from a private firm, DrillingInfo, which uses digitized courthouse records to determine ownership. This service requires a one-time subscription fee of $125,000 (DrillingInfo 2015). Other Eagle Ford studies have attempted to estimate royalties as 20% of total revenues from oil and gas operations, which is a simple approach that yields an estimated $6.8 billion in total royalties paid during 2013; however, this does not take into account other forms of mineral interest (Tunstall et al. 2014; Tunstall 2015a).

2.5 Political Ecologies/Economies and Energy Geographies in a Texas Context

Besides the economic impacts of energy development, this thesis will also explore some of the political consequences of mineral estate development. In doing so, I will demonstrate how social relations become reworked in a boomtown setting. Furthermore, I seek to understand why Texas political relations have in the past two years become disembodied from the local and placed into a new state-level scalar level.

This thesis will focus on advancements in hydrocarbon specific political ecology literatures. Indeed, energy, in whatever form, deserves to be seen as a material object worthy of intense scrutiny and not necessarily as a conceptual branch of other resource geography studies (Huber 2015). Bridge's (2001) demonstration of how resource extraction obliterates the recognition of complex social and economic relations demonstrates this need for energy-specific research. Indeed, when the "periphery" is imaginatively transformed into a setting devoid of social and political struggle and made only for resource extraction, locally important histories and cultures are forgotten. While certainly this manifests in a variety of extraction regimes besides energy, Bridge's (2001) assessment of young student art showing Oklahoma as an oil producing state offers emotional evidence of how oil has changed not only the physical landscape (through the drilling of wells) but also the imaginative landscape. Parallels can easily be drawn between the reimagined Oklahoma and the changing south Texas environment.

However, resource extraction does not have to be experientially negative. There are three possible main mechanisms by which petro-extraction catalyzes economic production: 1) the creation of forward (e.g., downstream petroleum processes) and backward (e.g., using local labor for oil and gas well construction) processes; 2) corporate social responsibility initiatives; and 3) tax and royalty payments (Bebbington 2012). These forward and backward linkages can potentially be used to develop knowledge intensive industries if leveraged properly (Marin, Navas-Alemán, and Perez 2015). However, in a statement akin to Emel and Roberts' (1995) examination of west Texas aquifers, Bebbington (2012) is quick to argue "the effects of extraction in any

territory and the ways in which it is negotiated depend very much on the prior political economic history of that territory, as well as national political economic history" (25). This claim recognizes that the nature of tax and royalty benefits is largely dependent on the political and economic institutional culture—an aspect of hydrocarbon extraction that will loom large in the present thesis.

U.S. hydrocarbon-related development should be situated relative to other economic endeavors. On-shore U.S. hydrocarbon development has been relegated to local (Fry 2013; Fry and Brannstrom 2015; Fry, Brannstrom, and Murphy 2015) and state governments (Davis and Hoffer 2012). This liberty to dictate policy has resulted in wildly different outcomes, ranging from a complete moratorium, and subsequent ban, on fracking in New York (Brasier et al. 2011; Klopott 2015) to Texas's reputation as a "neoliberal hydrocarbon utopia" (Fry, Brannstrom, and Murphy 2015, 2591). Among states that support oil and gas production, policymakers focus on growth-first (Peck and Tickell 2002) and other pro-economic/pro-employment discourse approaches to regional development. This mobilizes and maximizes support for energy development (Rabe and Mundo 2007; Mercer, de Rijke, and Dressler 2014) and may include "race to the bottom" strategies (Rabe and Mundo 2007, 269) that seek decreasing regulation to retain local businesses or lure firms away from neighboring states. Consequently, state-level deregulatory policies seem to emulate competitive markets (Peck and Tickell 2002), something that has become readily apparent in Texas fracking discourse where energy "companies… enjoy considerable latitude in their pursuit of drilling opportunities with relatively few state-level restrictions" (Davis 2012, 184).

Texas exists in a regulatory tangle in which oil and gas production is elevated over other economic endeavors; while Texas municipalities hold relatively more power than equivalents in other states, the anti-regulatory ethos inhibits substantive fracking regulations at either the local or state level (Rahm 2011). Furthermore, close ties between the Texas Railroad Commission (RRC)—the state's oil and gas drilling regulatory agency—and industry complicates monitoring efforts. However, municipal Texas governments have had, at least until May 2015, relative success in contesting neoliberal practices through distance requirements between oil and gas wells and homes as well as through environmental regulations (Fry 2013; Fry, Brannstrom, and Murphy 2015). This is especially important given that local residents and government officials are intimately aware of energy extraction's social and environmental consequences and yet still believe that it provides economic development potential (Anderson and Theodori 2009; Theodori 2012). Nevertheless, legislation passed at the state level in 2015, House Bill (HB) 40, prohibits (i.e., preempts) municipal governments from implementing regulations that are not "commercially reasonable" (Darby et al. 2015; Maqbool 2015); this law will be one of the foci for this investigation.

In Texas, energy firms prefer regulatory guidelines at the state level. This practice shields industry practices from the federal government (Davis and Hoffer 2012). As Davis and Hoffer (2012) note, this is largely driven by four factors. First, since the energy and the environmental regulatory bodies are typically separate at the state level, firms can focus lobbying efforts that align with the energy body that seeks oil and gas development. Second, state legislators are more accessible and easily swayed by industry

discourse due to the smaller constituencies. Third, industry advocates use their positions to demonstrate business transparency and describe economic benefits at a local level—using inter-firm concordances and economic benefit studies respectively. And fourth, industry officials are able to demonstrate that they can abide by state regulations, thus minimizing the need federal involvement in environmental regulations. Firms are able to influence state-based fracking regulations through two methods: 1) propaganda and speech, as well as 2) redefining societal relationships to the environment (Mitchell 2006; Hudgins and Poole 2014). While Davis and Hoffer (2012) help understand why fracking regulations have been largely absent from federal intervention, they do not answer why industry and mineral interest holders are equally opposed to municipal and county regulations—something the present study will consider.

While not mineral based, Brannstrom et al. (2015) examined West Texas wind energy royalties using tax appraisal data, electricity grid utilization reports, and semi-structured interviews, closely mirroring the methodology employed by this paper. This investigation of the spatial nature of mineral wealth revealed a "property advantage"—in which certain properties were sought for wind energy development because of the size of the property or its spatial characteristics (i.e., topography)—and a "royalty paradox"—in which there was broad support for wind energy development despite only a fraction (61%) of wind royalties remaining local to the region. This thesis will assess whether similar circumstances exist on the Eagle Ford Shale.

The ability for extraction firms to disrupt human-environment relationships, mainly through air and water quality deterioration, has been an emergent theme in

critical fracking research. However, longitudinal and comparative research on the fracking industry's potential economic—through mixed-methods approaches—and social—through locally-grounded studies—consequences is needed (Lave and Lutz 2014; Willow and Wylie 2014). This is especially important during an energy boom, when local governments are overwhelmed by an onslaught of development and the social fabric is in flux (Gilmore 1976), something this study carries out.

2.6 Conclusion

This thesis contributes to the regional development, boomtown, resource governance, mineral economics, and political ecology literatures by filling key gaps and relating theses gaps to the resource curse. Specifically, this thesis will explore how aspects of the resource curse are manifest at the county and region levels through an examination of concentrations of mineral wealth and the negative social disruptions to Eagle Ford pre-boom lifestyles. These local realities are important and represent the experience of Eagle Ford residents.

In fulfilling this promise of examining the local, this thesis will revisit Gilmore's problem triangle and revise it for a modern oil production context. Furthermore, despite the fact that mineral wealth has been assessed at a variety of spatial scales, this thesis will examine it at the county level—a first. This study also extends beyond only examining personal royalties and will also determine relative mineral ownership. Finally, this project will examine why industry and mineral owners equally shun federal and municipal regulations and instead focus at the state as well as why local

development officials still embrace mineral development, despite most mineral properties having absentee owners. Using the tools presented in the next section, I will explore these over-generalized and underdeveloped topics and present them in a modern Eagle Ford Shale context.

3. RESEARCH DESIGN, DATA, AND ANALYTICAL PROCEDURES

3.1 Introduction

This section describes the methods and data used by this thesis. Broadly, I employ two main techniques: semi-structured interviews with economic development stakeholders across the Eagle Ford Shale (Objective 1) and an analysis of mineral wealth using public tax appraisal data from the Live Oak County Appraisal District (LOCAD) (Objective 2). The semi-structured interview protocol will be discussed first. I describe the interviewee selection process, describe the questions asked of stakeholders, and provide some context for the results. The outcomes derived from this methodology will be examined in Section 4 as well as give some context to the results presented in Section 5. To augment the data, I attended several Eagle Ford-related conferences and collected data that will be integrated with the semi-structured interviews. In the second half of this section, I will discuss the methods used to obtain, process, and analyze the publicly available LOCAD mineral data. These data will be used to assess mineral wealth in Section 5. The Institutional Review Board (IRB) Number for the semi-structured interviews was IRB2013-0157D, and the project was funded through National Science Foundation grant #1265251.

An attempt to distribute a survey to oil and gas firms regarding Eagle Ford employment and recruitment was not successful. After discussing the survey with energy officials and firm human relations personnel, the projected response rate was expected to be too low. Specifically, employees who would have been recruited to complete the survey are instructed by their firms to not respond to surveys unless they are sent by

their own firm or by regulatory agencies; I also learned that some of the information we sought to obtain would have been interpreted as proprietary and possibly offering competitors a market advantage. Additionally, I amalgamated data (e.g., number of employees, previous year's profits, subsidiary status with other companies) on over Eagle Ford 400 firms, however after cross checking some of the data, there were inconsistencies. For example, the online business database, Hoovers, notes that Enervest Operating, LLC, has 125 employees (Hoover's 2016). This differs from the company-reported 1,200 employees (Enervest 2015). This database has served as a reference but will not be considered in the results.

3.2 Semi-Structured Interview Protocol

A research team comprised of two colleagues—a PhD student in the Texas A&M Geography Department and a PhD student from the University of Brasília—and I interviewed economic development officials about their perceptions of the Eagle Ford Shale economic development. This research targeted those individuals who were involved in the economic decision-making process. This included chambers of commerce personnel, city and county government officials, and economic development corporation managers. This initial contact would then indicate other local decision-makers to co-participate in the interview. On several occasions, the researchers were able to carry out impromptu interviews with willing respondents.

Our respondents can be loosely grouped into two geographic subareas of the Eagle Ford Shale: the core 15 counties (n = 8) or the peripheral 11 counties (n = 7)

(Table 1). To better align this study with other investigations of the region, I identify Lavaca, DeWitt, Gonzales, Wilson, Karnes, Bee, Live Oak, Atascosa, McMullen, La Salle, Frio, Zavala, Dimmit, Maverick, and Webb counties as the core production area (Rahm et al. 2015). These counties also align with the core counties mentioned in Tunstall et al. (2014). Any counties that are on the Eagle Ford not identified in the aforementioned studies as a core county are acknowledged as periphery production counties.

The research team interviewed 15 respondents in 11 unique interview sessions, using questions that we had selected based on our research goals and the nature of the literature (Appendix A). Each interview took between thirty minutes and two and a half hours. After establishing the credentials of the interviewee, we asked questions about the amount of local governance control over drilling on the Eagle Ford Shale. If a municipality had an oil and gas ordinance, we would query individuals about the motivation and the history of that ordinance and ask for any feedback they had received from the citizenry. Afterwards, we assessed economic development successes and failures. We questioned respondents about the role of industry in their jurisdictions, such as the accessibility of their particular office to oil and gas firms. In the second half of the interview, we would ask about the mobilization of the workforce. These questions assessed the amount of local employment and the type of training required to obtain permanent employment. We also queried the amount of on the job training oil and gas firms offered employees and the amount of mobility among oil and gas workers. Toward the end of the interview, respondents were asked to provide some background on

mineral ownership in their jurisdictions, as well as reveal whether their organization, municipality, or they personally owned a mineral estate. To complete the interview, we asked interviewees to provide some insight on the future of Eagle Ford related development in their jurisdictions. Respondents indicated the number of years they expected the Eagle Ford Shale to be active as well as the nature of short-term and long-term employment in their municipality or county.

Table 1: Interviewee respondent codes, job titles, interview date, and setting.
Core is defined as Lavaca, DeWitt, Gonzales, Wilson, Karnes, Bee, Live Oak, Atascosa, McMullen, La Salle, Frio, Zavala, Dimmit, Maverick, and Webb counties (Rahm et al. 2015).

Respondent Code	**Job Title**	**Setting**	**Interview Date**
EFS001	Alder Person (City Councilman), Chamber of Commerce Chair	Town[2] in Core Production County	8/11/14
EFS002	Director, Chamber of Commerce	Town in Core Production County	8/11/14
EFS003	President, Chamber of Commerce	County Seat in Core Production County	8/12/14
EFS003	Immediate Past President, Chamber of Commerce	County Seat in Core Production County	1/14/15
EFS004	Director of Operations and Public Affairs, Chamber of Commerce	Town in Peripheral Production County	12/12/14
EFS005	Director, Chamber of Commerce	Town in Core Production County	1/8/15
EFS006	City Manager	Town in Core Production County	1/8/15
EFS007	City Manager	County Seat in Core Production County	1/14/15

[2] A "town" refers to a municipality that is not the county seat.

Table 1: Continued

Respondent Code	Job Title	Setting	Interview Date
EFS008	Vice President, Chamber of Commerce	County Seat in Core Production County	1/14/15
EFS009	Director, Chamber of Commerce	County Seat in Core Production County	1/14/15
EFS010	Executive Director, Chamber of Commerce	County Seat in Peripheral Production County	2/6/15
EFS011	County Commissioner	Peripheral Production County	2/6/15
EFS012	Chairman of the Board, Chamber of Commerce	County Seat in Peripheral Production County	2/6/15
EFS013	Executive Director, Economic Development Corporation	County Seat in Peripheral Production County	2/6/15
EFS014	County Commissioner	Peripheral Production County	3/10/15
EFS015	County Judge	Peripheral Production County	3/13/15

We selected a spatially diverse (i.e., respondents from all the major drilling areas of the Eagle Ford Shale) group of interviewees to obtain a holistic view of the drilling boom and its possible bust (Table 1). Furthermore, we targeted individuals from a diverse group of local agencies such as local and county government, economic development corporations (See Jarmon et al. 2012 for a detailed analysis of Texas economic development corporations), and business advocacy organizations (i.e., chambers of commerce). These interviews were executed over approximately nine months, with the first completed in August 2014. We resumed the interviews in December 2014 and continued them through March 2015. The interview sample frame

was purposive; the individuals selected for this study were chosen based on their expertise and their role in the economic development of their cities or counties. This is the first known scientific interview based study of the Eagle Ford Shale region, thus enabling comparisons between south Texas and other shale production regions, such as Anderson and Theodori (2009) on the Barnett Shale or Silva and Crowe (2015) on the New Albany Shale.

3.3 Development Future on the Eagle Ford Shale

This research captures views of economic actors regarding the future of the Eagle Ford Shale as West Texas Intermediate (WTI) oil prices dropped from $92 per barrel at the start of the data collection to $45 per barrel by March 2015 (Figure 3). Eight respondents were still optimistic about oil and gas exploration in their local governments, four were concerned about short-term retrenchment but were still optimistic about the long-term viability of the play, and three offered neutral or negative statements that energy development would soon stall. Only one respondent was cautiously negative about the future of the play. Of those offering optimistic short-term or long-term perspectives on Eagle Ford development, the majority was in the core counties. These data will be used to help demonstrate how economic development perspectives shifted over the course of the interview period.

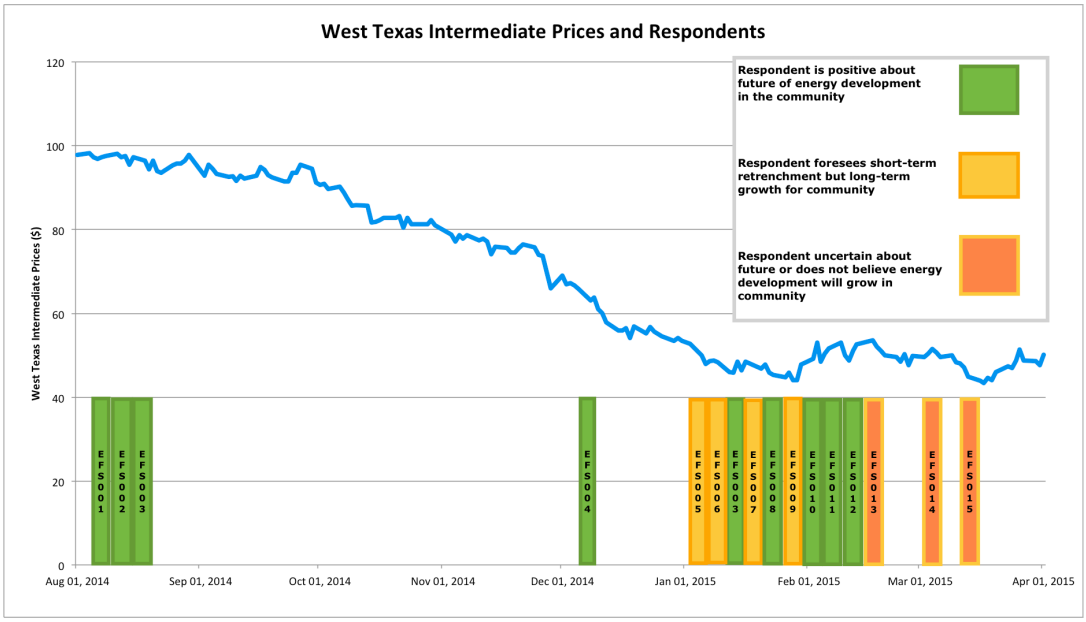

Figure 3: This graph demonstrates interviewee sentiment about the future of oil and gas drilling on the Eagle Ford Shale relative to the WTI price of oil. To protect the identities of the respondents, interview dates are approximate. Oil pricing data comes from Energy Information Administration (2015b).

3.4 Conference Participant-Observation and *Texas Eagle Ford Shale Magazine*

To better understand the discourse used by local stakeholders and energy professionals regarding the development of the Eagle Ford, I attended conferences that focused on play-related development: the 2015 Unconventional Resources Technology Conference (URTeC) (July 2015) and the UTSA Eagle Ford Shale Community Development Program (EFSCDP) Best Practices Conference (June 2015). In both cases, I engaged in participant observation and took field notes. The former was attended by geologists and geophysicists from across the world with approximately eight hours of the three-day conference schedule devoted specifically to Eagle Ford Shale. URTeC was very much a themed space devoted to oil and gas production from unconventional sources: part trade

show, part academic research conference. (For a detailed description of themed spaces at fairs, refer to Brannstrom and Brandão 2012.) In the EFSCDP conference, local policymakers and economic stakeholders worked with researchers from UTSA to workshop new ideas on how to best grapple with the development challenges on the Eagle Ford. The discourse at the meeting often revolved around ways to manage boomtown development and prepare for the imminent retrenchment in activity given the decrease in oil prices. Additionally, I analyzed articles from the *Texas Eagle Ford Shale Magazine*, "a monthly publication dedicated to promoting business and industry in the Eagle Ford Shale as well as globally" (Castillo-Swallow 2015), to gain an industry perspective on the growth in the region.

3.5 Qualitative Data Analysis

My research team and I transcribed interviews in the qualitative research software Atlas.ti, and Transcriptions—a free, downloadable transcription assistance software for Apple computers. I analyzed the interviews and data from the *Texas Eagle Ford Shale Magazine* using Atlas.ti. I used response-driven codes to capture the perceived regional and workforce development from stakeholders. These codes are found in Appendix B. The list of codes is standard throughout the analysis of the interviews, conferences, and magazine clippings. My coding methodology is founded in the grounded theory approach, which Creswell (2012) describes. The coded fragments from the interviews were then exported to Microsoft Word, where the data were refined. Afterwards, the data

was exported into Microsoft Excel for data presentation and to facilitate integration into results. In Excel, the data were color coded and interpreted to find emergent themes.

3.6 Mineral Wealth Analysis

I examined mineral wealth on the Eagle Ford Shale using publicly available county appraisal district data as a proxy. I used the methods established in Fry, Briggle, and Kincaid (2015) to assess the relative spatial concentration of Eagle Ford mineral wealth. To acquire this data, I contacted seven county appraisal districts (CAD) in the core of the play. Four CADs responded, and of those, I acquired data sets from Karnes, La Salle, and Live Oak counties. The nature of the data is displayed in Table 2, which shows that only Live Oak County provided immediately useable datasets. The other counties provided data in PDF format, which would have required a major time investment for conversion to formats that would support analysis and visualization in ArcGIS. Therefore, they were excluded from this analysis.

Table 2: The nature and usability of the mineral appraisal data acquired.

	Karnes County	**La Salle County**	**Live Oak County**
Data Format	PDF (2009-2010, 2014-2015), Excel (2013), CSV (2011-2012)	TXT and PDF Files	CSV File
Appraisal Years Available	2009-2015	2008-2015	2010-2015
Mineral Values	Yes	Some	Yes
Mineral Interest Holder Address Data	Yes	Some	Yes

Table 2: Continued

	Karnes County	La Salle County	Live Oak County
RRC Lease or API Number	Yes	Some	Yes
Types of Mineral Interest Present	Some Years Royalty, Override, and Working	Royalty, Override, Operator, Working,	Royalty, Working, and Override
Usability	Partially Usable (2011-2013)	Partially Usable with Significant Processing	Immediately Usable

Despite my requests to the appraisal districts for non-PDF format data, county appraisal districts often sent summarized PDF reports that are unusable for the analyses required of this thesis. Text (TXT) files require considerable time, several hours per file, to process into comma separated values (CSV) files—a useful data format for ArcGIS analysis. Therefore, of the three counties for which I acquired data, Live Oak County was the only appraisal district that distributed data requiring minimal processing and could quickly be useful for the present thesis. If time permits, I will return to Karnes and La Salle counties.

3.6.1 Developing a Mineral Estate and Many "Interests"

When mineral estates are developed, the mineral owner leases the subsurface property to an oil and gas firm. First contact is usually made through a land(wo)man, who has verified the ownership of the mineral estate. This person then acts as a liaison between

the future well owner and the mineral owner. After contact is established, the mineral estate owner signs a contact leasing the estate to an oil and gas drilling company. These leases typically last for five years (Weber, Brown, and Pender 2013), and if production starts, then the lease can be renegotiated or extended.

When the lease is established, there are a variety of interest types that are used. The most recognized, the royalty interest, is the fraction of the mineral value extracted that is paid directly to the lessor usually free of production or refinement costs. Working interests refer to the firm that is developing the mineral estate; in this case, the working interest usually assumes the largest interest stake in the well but is also responsible for the costs of drilling, operations, and environmental cleanup at well abandonment (Brown, Fitzgerald, and Weber 2015). Overriding interests are the third main type and denote those companies that assist in the drilling of the well in service of the working interests. This assistance can either be financial, legal, or actual well work. Overriding interest is always cut from the working interest and was historically used to pay for legal counsel, retain key employees, and compensate another company during periods of joint ownership. This royalty, similar to the property owner royalty, is usually free of production costs (Theriot 2012).

The typical mineral lease has a combination of royalty, working, and overriding interests. The final and least common mineral interest that will be examined in this thesis is the production payment interest, which directly uses the value of the well production as collateral. The owner of the payment interest is entitled to a portion of the oil and gas profits, free of costs, until an agreed upon threshold is met. Then, the interest reverts to

the working interest holder (Theriot 2012). While other types of interest exist and are frequently used by the oil and gas industry (e.g., wellbore interest, carried interest, net profit interest), they were not present in the data from LOCAD and therefore will not be analyzed. In order to determine the lease type, some minor data processing—the splitting of a unique account number—was required.

3.6.2 Mineral Assessment in Live Oak County

Capitol Appraisal Group, LLC, is the contractor that appraises mineral properties in Live Oak County. The tax assessor only appraises mineral properties when the estate has been developed (i.e., hydrocarbon production is taking place). This contractor uses an income approach in which the company estimates the remaining reserves of the property and the time through which those minerals will be extracted. This, in turn, creates a future income on a year-by-year basis that is discounted to present-day dollars. Those incomes are then aggregated to give the total appraised market value of the property (i.e., the value of the property if it were sold at market value on the day of appraisal). That value is then compared to the previous year's actual income from the property for quality assurance (Capitol Appraisal Group 2012). Generally, a mineral property's value should be two to five times the amount of the previous year's income (Texas Comptroller of Public Accounts 2013).

Appraised values are not precisely equal to the market mineral value; however, it is almost impossible to determine individual mineral incomes short of communicating with or surveying individual mineral estate owners about their mineral interests (Kelsey

et al. 2011). Appraised values, therefore, act as a proxy for total predicted income over the remaining life of that mineral property. These appraised values have appeared in the energy literature through Fry, Briggle, and Kincaid's (2015) analysis of mineral wealth in Denton, Texas. Other methods exist for assessing relative mineral wealth, such as examining courthouse records at a cost of $125,000 for a database (Brown, Fitzgerald, and Weber 2015) or assuming that absentee mineral ownership is the same as surface mineral ownership (Kelsey et al. 2011). The public and the Texas Comptroller accept the methods used by LOCAD as a valid way to appraise mineral properties. Furthermore, these data are readily available and inexpensive compared to Brown, Fitzgerald, and Weber (2015). While there is likely some overlap in absentee and local *surface* property ownership versus *mineral* ownership, it is much more accurate to directly analyze the mineral estate. Appraised minerals also provide a spatial component that can determine the amount of absentee mineral ownership. This wealth concentration is based on the percentage of the mineral interest held or owned relative to the total value of the mineral estate.

The validity of these data is accurate to within the tax data provided by LOCAD. This methodological approach is not without its shortcomings. Since LOCAD only appraises those mineral properties that are actively producing hydrocarbons, unexploited or inactive mineral estates are not assessed. Furthermore, a firm's or person's tax address may not always equate to the actual address. For individuals (non-firms), this sometimes implies that royalty goes to a family trust or lawyer's office. This suggests that their tax address and actual address may not be the same. Companies may incorporate in multiple

states or countries. For example, the first oil and gas firm to frack a modern well on the Eagle Ford Shale, Petrohawk Energy, was subsequently acquired by BHP Billiton in 2011, which has a U.S. regional headquarters (the tax address of their Live Oak County wells) in Houston, Texas, yet is globally headquartered in Melbourne, Australia. Even from a simple mineral ownership or leasing perspective, this dynamism creates complex webs of networks that entail prohibitive effort to disentangle. For a thorough investigation of energy industry corporate networks, refer to Bridge (2008). This phenomenon will become more apparent in Section 5.

3.6.3 Mineral Wealth Data Workflow

For the six datasets (one for each year, 2010 to 2015), I first separated the unique tax identification numbers into columns (Figure 4). This enabled me to distinguish the four types of interests. Using the appraisal data, I calculated relative Gini coefficients through free online calculators; these data were verified across multiple websites (Rosenmai 2012; Had to Know 2016). These websites use the Lorenz curve to graph and calculate Gini coefficients. As per Texas law, all mineral properties that are appraised at less than $500 are not taxed and therefore are not incorporated into this study. LOCAD also provides the tax addresses of the mineral interest owners and holders. I geocoded the mineral interests in Live Oak County using Texas A&M University GeoServices to determine geographic coordinates (Goldberg 2015). As a form of consistency, duplicate company records—or records that are going to the same taxing entity (company or person) yet treated differently by LOCAD—were merged (e.g., Pioneer Natural

Resources and Pioneer Resources Producing) for table construction in Section 5. These data were then uploaded into ArcGIS where I could differentiate "local" (within Live Oak County) and "non-local" (outside Live Oak County) addresses. In ArcGIS, I assessed the relative concentration and spatiality of the mineral wealth. I acquired Shapefiles of the Eagle Ford Shale from the EIA (2014); this data is used to evaluate regional ownership of Live Oak County mineral properties. The results of the spatial analysis have been reported in table format and via cartographic products, which have been processed and visually enhanced in Inkscape—an open source graphics editor. For cartographic purposes, when discussing total mineral wealth, I merged an entity's total mineral ownership into one address (using address and zip code). When data are displayed in my maps, I consistently used a quintile classification method. For total mineral data, I merged the data with states outside of Texas, so that the entire state's mineral wealth can be assessed, thus improving readability (due to the small nature of the inset map).

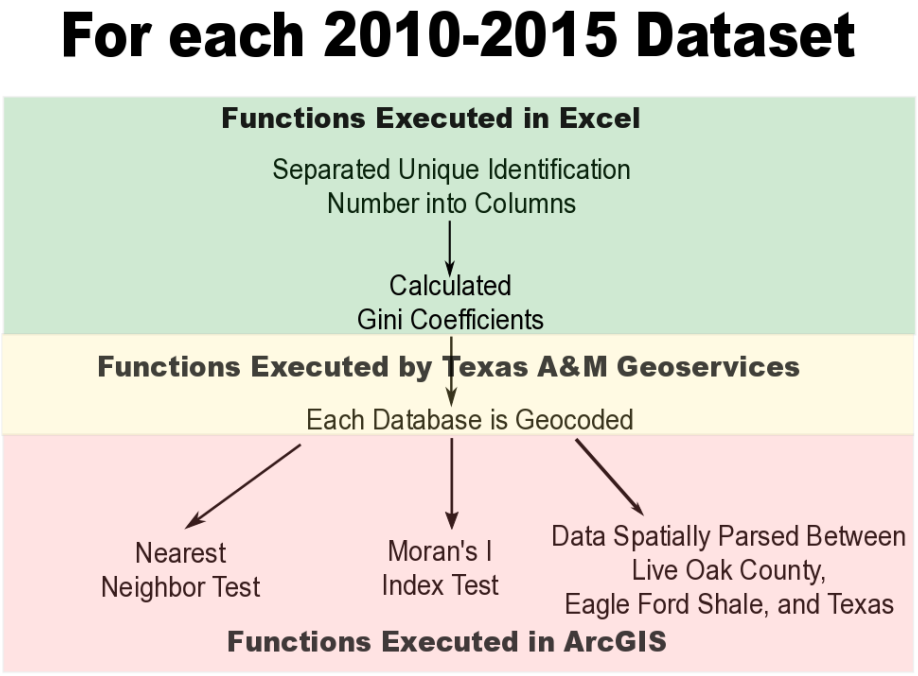

Figure 4: Workflow for LOCAD mineral interest data.

I also conducted spatial analyses that will provide quantitative measures of the concentration of mineral interests and the concentration of mineral interest holder. This is executed through Moran's I Spatial Autocorrelation and Nearest Neighbor tests respectively. I executed the Moran's I index using a "fixed distance band" for the "Characterization of the Spatial Relationship" as suggested by ESRI (2013). I tested Moran's total mineral ownership as well as for the individual mineral interest types. Payment interests do not have enough data to execute a Moran's test.

I define local mineral interests as those interests that have tax addresses within Live Oak County. Eagle Ford Shale mineral interests are any Live Oak mineral interests that have a tax address on the Eagle Ford Shale as defined by the Energy Information

Administration (EIA) polygon. This is an important distinction, because only part of Live Oak County rests within the EIA boundaries of the Eagle Ford Shale. Therefore, if there are tax address locations in the southern part of the county, then it will be counted as part of Live Oak County total *but not necessarily as part of the Eagle Ford Shale total*. I define in-state mineral ownership as those addresses are found within Texas.

Fry, Briggle, and Kincaid (2015) analyzed mineral interests for individuals, but here I analyze total mineral interest data. For example, Fry, Briggle, and Kincaid (2015) focused on ~16%, not analyzing ~84% of total value; moreover, they only analyzed minerals under the city of Denton, rather than the entire county. The present study is only focusing on one year's data, 2015, on the basis that the appraised value already incorporates the full market value of the mineral property. Fry, Briggle, and Kincaid (2015) summed then averaged the wells' valuation from 2002 to 2013.

There are differences that would preclude this study from doing the same. In Denton's case, the wells are almost all natural gas and drilled prior to 2008. Given that fracked wells have a steep production decline after production has commenced, the vast majority of wells were very mature. In Live Oak County, production peaked in 2015, so the majority of wells are relative new and are still producing large amounts of hydrocarbons. Therefore, there are a wide variety of production profiles amongst the wells in Live Oak County in comparison to Denton. Averaging the value would disadvantage newer oil drilled after the drop in oil prices in beginning in June 2014. Wells drilled since June 2014 could (and typically do) have higher initial production rates despite having a lower valuation due to decreased oil prices (EIA 2015a). Finally,

conversations with the authors of Denton study indicated that this aspect of their research was one of the most contentious aspects of their research during peer review and very time consuming. It required linking appraisals with RRC well locations using American Petroleum Institute (API) numbers. They then tracked an individual well's performance over the course of their study period. LOCAD did not include the API numbers and instead looked at production across entire leases (not individual wells) that might contain multiple wells drilled at different times. Given these restrictions, I decided to focus on one year's data, 2015, and analyze the 2010-2014 data relative to the findings from 2015; therefore, I will not average how specific lease valuations change over time.

3.7 Conclusion

This section has explained the thesis methodology. To achieve Objective 1, I used semi-structured interviews with economic development corporation leaders, elected and appointed municipal government officials, elected county government officials, and business advocacy organization spokespersons. In doing so, I mirrored a recruiting methodology used by Anderson and Theodroi (2009). To augment the semi-structured interview data, I have incorporated data from two conferences and a monthly industry magazine. I have qualitatively coded these data using a grounded theory approach and have drawn conclusions that will be represented in Section 4.

To achieve Objective 2, I will mirror Fry, Briggle, and Kincaid's (2015) methods. I acquired public county appraisal data, which will serve as a proxy for mineral

ownership and holdings. I processed then uploaded these data to ArcGIS where I conducted spatial analyses. These data are then used to examine distribution of mineral wealth. These results are reported in Section 5. In Section 6, these data will then be used to assess normative mineral ownership discourses reported by the academic literature as well as provide some context for shifting political economy using data from Section 4.

4. VIEWS OF ECONOMIC DEVELOPMENT IN A BOOM-BUST MILIEU

4.1 Introduction

This section examines the main challenges to economic development on the Eagle Ford Shale. In doing so, I scrutinize how local economic development officials (described in Sections 2 and 3) respond to growth in their jurisdictions. I begin by describing the powers of Texas municipal and county economic development officials. After, I discuss how local officials approach economic development. I then discuss House Bill 40 as another way to describe how stakeholders perceive of their economic development landscape. I situate this section around three major negative respondent reported negative ramifications to economic development: road degradation, temporary housing, and wages. These top three consequences emerge from using a grounded approach to interview coding. Development officials from across the region cited these three hindrances that restrict being able to fully take advantage of the Eagle Ford Shale. I relate these findings to the problem triangle used in Gilmore (1976) (Figure 2). I link the social disruptions discussed in this section—roads, housing, and wages—to the resource curse. I conclude this section by linking the findings together to offer a renewed look at Gilmore's (1976) triangle.

The policy domains discussed in this section are described in Table 3. Roads, housing, and workforce/wages—will be used to help explain the latter domains. I will briefly discuss these here and provide a more developed description of these ramifications later in the section.

Table 3: Policy domains, descriptions, and how the boom in energy exploration has impacted that policy domain.
This section will focus on the first three domains (delineated by thick line), and incorporating data from the other domains as relevant.

Policy Domain	**Domain Description**	**Energy Boom Ramification**
Roads	Local governments build and maintain most roadways	Degradation of local roads from overuse forces frequent maintenance and use of resources
Housing	Municipalities have some control over the type of housing (short versus long-term) built in city limits through permitting	Housing demand so great that regulations are circumvented and accommodations (planned and unplanned) built in unincorporated areas
Workforce/Wage	Local governments have limited capacity to increase wages	Local workforce experience higher wages (Tunstall 2015b), enabling more consumption causing more tax revenues, but have difficulty attracting labor from industry
Regulatory Policies	Economic development officials have the opportunity to regulate growth through policymaking	State advocates for resource economy (Rahm 2011); local regulatory capacity restrained
Energy Firm-Organization Partnerships	As economic growth officials, must maintain close partnerships with firms	Very close partnership might lead to unregulated growth and resource curse ramifications
Tax Policies	Taxes can be used as a policy instrument to regulate growth	Communities attract certain industries using tax abatements; despite the need for local governance, restricted on tax increases

Local governments are charged with managing the infrastructure, however in the midst of a boom, energy firms overuse roads causing them to deteriorate. As the most

discussed ramification of the energy boom determined through transcript coding, local economic development stakeholders were fearful that the deterioration of infrastructure would slow future growth and provide an unsafe environment for local residents. Economic policymakers are developing imaginative techniques to manage this ramification of boomtown growth—from repatriating lost royalties to incremental tax increases.

The second most discussed negative shock determined through coding was the extraordinary housing demand. With the arrival of oil and gas extraction came thousands of workers from beyond the Eagle Ford Shale. This quickly overwhelmed the local housing stock, forcing an increase in real estate and leasing prices. To combat high demand in the housing market, economic development officials are using a variety of methods to manage hotel-motel development, in some cases purposefully slowing housing construction to ensure the long-term development goals.

The arrival of the oil and gas industry brought a significant demand for semi-skilled and skilled labor, causing a corresponding spike in local wages, which was the third most discussed consequence of boom development as determined through interview coding. While potentially beneficial for official state statistics, this has dramatically impacted local governments that are unable to retain workers. Furthermore, low-skilled labor, such as non-energy construction, has been negatively impacted by the sharp increase in wages. Nearly every economic development official recognized how high wages was causing concern amongst local governments and non-energy firms.

4.2 Economic Development and Actors in Context

4.2.1 Powers and Policymaking

Local Eagle Ford economic development agencies come in a variety of forms—from municipal and county governments to chambers of commerce. Chambers of commerce advocate for pro-business policies at the local government level; they are also used as sites of training and preparation for running a small business (Lacho and Brockmann 2015). Of importance to this thesis, they are also sites of business cohesion and cooperation during times of shock (Lacho, Bradley III, and Cusack 2006). Chambers of commerce are non-profit organizations that are deeply embedded into their representative host regions and have influential economic development outcomes (Schapiro Group 2012). However, the participation of firms in chambers of commerce involvement is voluntary, and while chambers have a direct influence on policymaking, they are not policymakers. In Texas, chambers of commerce are directly linked to the municipality or county that hosts them through a portion of tax receipts, usually from tourist activities (e.g., hotel-motel taxes).

Local economic development corporations, on the other hand, have the ability to implement policies. While the corporation itself is usually independent of the municipalities that host them, there are social and political linkages between the corporation and the city in that they are financed by a fraction of tax revenue. In Texas (depending on the structure of the development corporation), they fund job creation and retention programs, as well as lure and support business growth in the municipality by funding commercial ventures and building industrial facilities (Jarmon et al. 2012).

Economic development corporations lobby the municipal government to implement tax policies and regulations that can attract certain businesses. Given their ability to build business space and peripherally manage policies, they are important drivers of economic development in Texas and play an important role in Eagle Ford economic development.

As one of the major agencies charged with economic development, Texas county governments maintain transportation infrastructure, manage the judicial system, collect property taxes, maintain public records, direct the public safety of the county, and register voters (Texas Association of Counties 2015). This regulatory authority is explicit; county governments must not exceed these powers and have limited ability to regulate oil and gas drilling. Therefore, drilling in unincorporated land must comply with RRC protocols and any infrastructure-related regulations that the county government has in place. Counties may charge a small fee (usually on the order of a few hundred dollars) for permits but have no control over well site, situation, or environmental regulation. From an economic development perspective, county governments can help manage the tax policies by working with municipal governments and economic development corporations to attract certain industries through tax abatements.

Municipal governments, on the other hand, are given considerable liberty to operate free from state oversight as long as oil and gas ordinances are couched in terms that benefit the general health and welfare of the public (Fry 2013). This is especially true for population centers greater than 5,000 that have received "home-rule" status. These municipalities "look to the state constitution and state statutes to determine what [the city] **may not do"** (Texas Municipal League 2015, 9, emphasis in original).

Traditionally, municipal governments had been given considerable liberty to operate free from state oversight provided that regulations were couched in benefits for the general health and welfare of the public (Fry 2013). City officials have used this authority to create and implement regulations that manage oil and gas drilling in their municipalities.

4.2.2 Economic Development

To many respondents, the Eagle Ford Shale offers a development opportunity that could persist for decades. Several respondents were aware that oil and gas development was likely to slow because the play would eventually shift from exploration to production paradigms however, others believed that high levels of employment and development would remain part of the economic landscape. In fact, interviewees (n = 5) were quick to point out that development would likely continue for the foreseeable future because of the multiple layers of shale rock found in south Texas.

> "I think they're going to keep on drilling. It's the price. The price is going to determine what's going to happen, but I think—like I told you—the seismograph crews are running up and down. It's still going to happen. I don't know how big or whatever. It's not over. This isn't like the first boom [on the Austin Chalk]. The first boom lasted 4 or 5 years. This one here is going to go on for I'd say 20 years probably. Did y'all ever see the bumper sticker—what is it? —'God, please send us one more oil boom and I promise I won't piss this one off'? I remember that sticker well." (EFS011).

The above passage encapsulates how economic development officials perceive the shale play. They are cognizant of the potential major fluctuations in drilling activity, yet hopeful that drilling will persist. They also believe that the boom will endure for

many years, potentially decades. Yet, economic control over this multi-decadal development is limited, because development is dependent on the price of oil, the nature of the organizations under which they are working, and the geology of the subsurface. This quote indicates that the problem triangle still is relevant in a modern fracking context: it illustrates how little control policymakers have over the Eagle Ford's development. Yet, the triangle does not perfectly demonstrate the Eagle Ford's developmental consequences on south Texas towns. These modifications to update the triangle and provide it a modern, oil-based context will be examined at the end of the section.

As discussed in the introduction, there are various policy domains that interviewees identified as important for economic development. I have amalgamated the main respondent-identified approaches to these policy domains. A summary of the responses to boomtown development is found in Table 4, with "Policy Response 1" demonstrating how entities more accepting of oil and gas development frame economic development in certain policy domains and "Policy Response 2" showing how cities and counties more averse to energy development frame development. These responses illustrate their responses to the problem triangle and how they mitigate against the negative externalities associated with explosive growth.

Table 4: Example responses to boomtown development impacts mentioned by respondents.
The "Policy Impact Response 1" column is meant to describe a location that is more accepting of oil and gas development than the "Policy Impact Response 2" column. The top three policy domains were explored explicitly in this section, with the latter four peripherally examined through the first three.

Policy Domain	**Policy Response 1**	**Policy Response 2**
Roads	Degradation of local roads from overuse forces frequent maintenance, straining local government budgets and negatively impacting economic development	
Housing	Focus on short-to-extended stay accommodations; Permanent housing also sought	Focus on permanent housing with little attention given to short-to-extended stay accommodations
Workforce/Wage	Using energy-tax revenues to seek more employees to help manage drilling	Using energy-tax revenues in improvement projects, not dramatically expanding the agency workforce
Regulatory Policies	Regulatory policies are loose and are not intended to slow energy-related growth	Policies are meant to regulate energy-related growth through strong ordinances and regulations
Energy Firm-Organization Partnerships	Strong partnerships	Weak partnerships
Tax Policies	Willing to offer tax incentives to energy companies to relocate	Not expressly offering tax incentives to energy firms—especially upstream firms

Some municipal and county governments prefer to take advantage of the current economic boom to build short-term accommodations house local workers and enjoy increased tax receipts. These tax receipts can be used to expand the economic diversity if invested correctly. Furthermore, this new revenue enables agency directors to hire more

personnel in the government and economic development corporations, which has the opportunity to expand economic development opportunities through the increased operational capacity of the organization. These actions, however, can make the municipality's or county's development susceptible to changes in petroleum prices.

In these circumstances, other cities and counties have preferred to abstain from short-term energy-related development. While restraining participation in the energy economy can have short-term drawbacks, economic developers have taken this opportunity to focus on firms that are already present. Additionally, cities and counties have the option to expand the agency's physical infrastructure as opposed to hiring more employees that could be impacted by a retrenchment in drilling activity. This view on economic development allows the government agency to expand but does not unnecessarily expand the public workforce to an unsustainable level. Furthermore, they believe that they are well situated if petroleum prices drop and the drilling boom slows.

4.2.3 Policymaking and Development Described through HB 40

When Denton—a North Texas city on the Barnett Shale particularly affected by the negative externalities of urban gas drilling—banned fracking by popular vote within the city limits in November 2014 (Malewitz 2014b), local governments were concerned that the Texas government would reduce the regulatory power held by cities. In direct response to actions taken by Denton, legislation passed at the state level in May 2015, House Bill (HB) 40, prohibits (i.e., preempts) municipal governments from implementing drilling regulations that are not "commercially reasonable" (Darby et al.

2015; Maqbool 2015), thus eliminating a potential regulatory tool Eagle Ford officials could use to slow development in the region.

Three Eagle Ford stakeholders expressed contempt towards Denton for instituting the ban, with one municipal official referring to them as "lunatics" and another calling the city "fools." These remarks demonstrate the political culture on the Eagle Ford Shale: municipalities operate independently from one another and believe that they should have full autonomy from the actions of other cities. In relation to the ramifications about to be discussed in this section (roads, housing, and wages), this also means that local leaders in each municipality offered independent approaches to solving these problems. But why were the stakeholders upset about the fracking ban? According to the three respondents, that ridicule is couched in two main perspectives: concern about local regulatory control and disruption of energy-related economic development.

First, local government officials at the time were concerned that the state would revoke all municipal oil and gas regulatory authority because of Denton's perceived overreach of power. While the passed version of HB 40 includes provisions that might protect certain city regulatory authorities, there is still ambiguity as to the meaning of the phrase "commercially reasonable" and the amount of regulatory power local governments lost (Heinkel-Wolfe 2015). Either clarifying language from future legislative sessions or court-related decisions will frame how HB 40 changes the Texas regulatory landscape. Respondents feared that HB 40 was going to require their cities to relinquish powers to the state or rollback preexisting fracking regulations, thus forcing them to become increasingly passive participants to the development taking place.

Even if there was a public impetus to implement stronger local regulations, it is unclear whether stringent local ordinances could be instituted. One local official admitted that his small town did not "have probably the *expertise* to try to regulate [drilling]" (EFS002; emphasis added by author). This was substantiated by a respondent in a different municipality who noted: "What I see in the difference between metro areas and rural areas, is that the rural areas do not have the same resources that the metro areas have in order to be able to bring a good, efficient government into the community" (EFS007). This is an important perspective given that much of the Eagle Ford-related development is taking place in rural areas that had been in economic decline until the arrival of oil and gas drilling. In this context, many of the productive unelected policymakers in the region have found opportunities in larger cities. Unfortunately, this marginalizes smaller towns that do not have the regulatory capabilities and expertise to implement regulations. At a 2015 UTSA Eagle Ford stakeholder's conference, one city administrator was adamant that there was a dire need for knowledge in crafting ordinances that can help regulate city development.

Framed in this way, municipal oil and gas ordinance preemption by the state could be a long-term issue if both a willingness to create more stringent laws and an expertise are found. Even if south Texas towns found the expertise and political will to regulate oil and gas, municipalities have a small spatial footprint compared to county jurisdiction. Additionally, the spatial extent of any municipal regulations—even if such regulations were implemented in every municipality—would pale in comparison to the

spatial size of the resource. In these circumstances, local government actors demonstrate their ability to regulate business practices more effectively than to regulate drilling itself.

Second, local economic development officials had difficulty sympathizing with Denton, as many saw the energy-related development central to the future growth of the Eagle Ford region. Those respondents who disapproved of the Denton fracking ban observed the city's action to be contradictory to the pretenses under which many south Texas local officials were put into office: help grow a stagnant or—in many cases—declining economy. With numerous locations in the Eagle Ford experiencing severe poverty leading into the boom (Tunstall 2015a), local officials were charged with pursuing economic growth to improve the economic vitality of their jurisdictions. This notion is substantiated by claims on other shale plays of governance actors noting economic improvements as one of the main effects of shale development (Anderson and Theodori 2009; Silva and Crowe 2015).

While this perspective has been the operative paradigm since the regional economic decline started in the early 1900s and accelerated in the 1930s-1970s (Tunstall 2014), local officials have been changing their opinions in light of the increasing volatility in the hydrocarbon markets. One respondent maintained how the oil and gas industry is able to take care of itself, and that it is much more prudent for the economy to diversify than expend resources attempting to attract energy companies to her town (EFS013). Similarly, at a UTSA stakeholder's conference local government officials mentioned how they were now focusing on the citizens and businesses already in their city as opposed to attracting new energy-related businesses. As of 2015, economic

development policymakers are targeting citizenry and businesses that are already in those jurisdictions than at any time previous in the boom.

While local governance actors perceive that they have some control over the development of their municipality, in the absence of a strong local regulatory regime, interviewees understand energy-related development to be inevitable. When asked whether the city ordinance he helped craft and implement were motivated by encouraging mineral production, one respondent chuckled and said, "Let me tell you: encourage mineral production, we can toss that out, because it was going to take place [regardless of the ordinance]" (EFS006). Other respondents (n = 3) discussed how their cities might have been too responsive to the energy-related growth demand in their towns and perhaps should have worked harder to resist energy-related growth. This is especially pronounced for towns that have permitted short to medium stay housing—such as hotels, motels, and extended stay accommodations—that is popular with the oil and gas industry: "I think that our town is growing with the oilfield here, but I'm hoping we will be able to sustain all the restaurants and hotels and everything like that… twenty years down the road" (EFS009). Some cities, such as Cotulla, Pearsall, and Kenedy, have specialized and take pride in building hotel capacity for the Eagle Ford Shale (Fox San Antonio 2014; Malewitz 2014a; Buchele 2015). All respondents mentioned the oil and gas industry's tendency to use hotels and motels while drilling a well and how that is positively influencing local tax receipts.

Finally, four stakeholders noted that their localities were well known among energy professionals for intentionally having few regulations: "As a matter of fact, we

use that as part of our sales pitch down here: That we don't have nearly the rules and regulations" (EFS003). It is unknown whether this persuasion has been effective; however, these actions raise questions of inadequate regulatory oversight and the possible implications of such growth, including the resource curse. EFS003's quote adds to previously mentioned accounts of the possible lack of expertise to craft impactful regulations. While it is difficult to determine whether the resource curse is taking place through purely anecdotal accounts, such reports should be taken seriously as this lack of institutional guidance can distort present developmental gains into future public liabilities. While not every resource economy experiences the ramifications of the curse (Larsen 2006), without strong institutional oversight a country's—or in this case, a region's or even a town's—economic and social stability is largely tied to commodity prices (Mehlum, Moene, and Torvik 2006; Michaels 2011; Ewers 2015; Tunstall 2015b). Given the volatility in oil prices, it is expected that parts of the Eagle Ford Shale region, poorly equipped to handle to major withdrawal of investment activity, could suffer.

Respondents (n = 8) were equally aware that economic development outcomes were closely tied to a commodity that is known for its drastic swings in price outside of their control. This was reflected in comments including "It's the price. The price is going to determine what's going to happen…" (EFS011) and "It all depends on the price of oil!" (EFS004). This is not the first account of government officials in hydrocarbon production regions being aware of price volatility and its role in shaping economic development outcomes. Indeed, Wilson (2004) notes how company mining towns are responsive to commodity prices in the same way that roller coaster is

responsive to its own tracks. Similar parallels exist on the Eagle Ford in which many municipalities and counties—while not necessarily burdened with being responsive to the variability of a single firm—are nevertheless responsive to the volatile, roller coaster changes in the oil and gas markets (Murphy 2015a).

Despite the decrease in drilling activity associated with diminished oil prices, respondents were not concerned with the fact that economic development was tied to oil prices. Rather, many embraced the idea of their local governments having persistent economic ties to petroleum and were aware of the economic potential of those oil reserves: “The reserves are here; it’s mainly a matter related to the price, as soon the price adjusts itself to whatever level they want, then the drilling will commence full speed ahead again” (EFS006). Even those respondents (n = 7) who made passing references to Lucas’s (1971) model of employment in a resource extraction regime were unconcerned by the drop in oil prices: "And although there is some diminishing on the exploration part [of drilling], the production side of it is still very active, no matter where the price of oil in the global markets is" (EFS007). All interviewees who mentioned oil and gas framed it in a way that inherently associated development with the price. The price, they always recognized, was outside of their control, yet it was just as essential to delivering positive economic development outcomes as any other policy (or otherwise) instrument. This is not to state that officials were ambivalent to the prices. Indeed, a few economic development stakeholders were attempting to insulate their jurisdictions from oil and gas price volatility by controlling the boom-related development in their communities.

This boom in activity is not the first time several Eagle Ford cities and counties have been impacted by oil and gas development. As discussed in Section 1, previous oil and gas drilling on the Austin Chalk centered in northern La Salle County, southern Frio County, along with Lee, Burleson, Fayette, and Brazos counties, which spurred strong energy-related development in the 1970s and 1980s. Economic development experts are taking the knowledge gleaned from these experiences and leveraging it to the current development on the Eagle Ford Shale. For example, one stakeholder whose town was strongly associated with the Austin Chalk noted, "In the first boom, we missed a lot of things, because we didn't know what to expect and we didn't know what was going to happen! And so as the second [(current)] boom comes along, they've [(local policymakers)] been a lot more cognizant of what do we need to do to make sure these companies—if they're all going to be here—what can we do to make them stay longer" (EFS010). This point about using the past to inform present conditions was mentioned multiple times during that interview and reiterated by other respondents from the region. While this is certainly the case on the Eagle Ford Shale, local actors may not implement lessons from the past. Moreover, experts do not necessarily retain knowledge from previous resource booms (Halseth and Sullivan 2004).

Economic stakeholders also mentioned how they use concurrent energy-development booms and busts occurring across the U.S. to inform their decisions. Whether that is researching Denton's developmental setting on the Barnett Shale or examining progress on the Bakken Shale, respondents were aware of other shale plays and were incorporating that knowledge into their decision making. For example, one

respondent's travels revealed a fate he did not want for his county: "I went to a conference out in Midland, Odessa, or out somewhere out there. And there was nothing! Big warehouses everywhere. I went, 'Oh man, that's horrible'" (EFS011). Respondents also inquired about my findings from the Barnett Shale and how those investigations could complement the preexisting local knowledge of energy-related development.

Some additional communication was taking place at the regional level. Interviewees were cognizant of decisions in other regions of the Eagle Ford Shale. Sometimes these inter-agency connections were cemented into working groups such as through advisory boards, consortia, networks amongst chambers of commerce, conventions, and industry-sponsored arrangements. Frequently, respondents noted personal relationships with other policymakers in their jurisdictions and across the Eagle Ford Shale. This included both horizontal bonds—relationships amongst individuals of the same type of organization—and vertical relationships—rapports amongst individuals of differing levels of agencies. As noted in the interviews, these connections not only disseminate knowledge about the shale boom quickly but also facilitate interactions between individuals or businesses and the government: "I think what happens is that when [oil and gas companies] came in to talk and usually they hit our office… all of the entities, the county and the city, are vertically aligned in the same trajectory" (EFS007). This is important for economic development for a variety of reasons, not the least of which is for tax abatements and permit filing. Depending on the regulatory structure of the local government, city, county, and other economic development officials can work together to entice companies to a particular location through property tax abatements.

This development instrument arose frequently in interviews as an effective way to entice targeted industries.

As noted by respondents (n = 5), the second advantage to having strong inter-government communication is to help potential business owners navigate through the local government bureaucracy. Depending on the nature and location of the business and the preexisting regulations of the city or county, there may be certain applications and permits that are required to a business beginning operation. Economic development corporations and/or chambers of commerce often work as facilitators between government and local businesses; however, economic development and chamber officials noted that it is much easier to assist newly formed businesses if all the major government entities communicate with each other.

The final method stakeholders have been using to inform decisions about the Eagle Ford Shale is through reading scientific studies and establishing networks with research institutions. The University of Texas at San Antonio, Texas State University, Texas A&M University, and Texas A&M University-Kingsville have a strong presence in the region and work with local stakeholders to inform them of best practices. Researchers at these universities also conduct on-demand economic analyses and act as nodes of information as energy development changes on a day-to-day basis. Many respondents made mention to at least one of these universities during the interviews.

4.3 Roads: "A Bunch of Straight Running Idiots"

Substantiating a claim made by Rahm, Fields, and Farmer (2015), a common narrative that arose in every discussion with economic development actors was the degradation of infrastructure from increased truck traffic and heavy loads over weight-limited sections of roadway. The main difference between Rahm, Fields, and Farmer's (2015) and the present study is the manner of data acquisition. The Rahm et al. (2015) study used a set of surveys distributed to municipal and county policymakers. Additionally, they did not query economic development organizations. They also focused on the core of the play, whereas my study incorporates findings from the core and the periphery.

According to a study conducted by the Texas A&M Transportation Institute, approximately 1,272 trucks-trips are required to drill and frack an oil and gas well on the Barnett Shale with an additional 88 truck-trips required per year for the life of the well to maintain the well and withdraw saltwater and flowback. If oil and gas company decides to refrack the well, another 997 trucks are required (Quiroga, Fernando, and Oh 2012). As a reminder, there are over 10,000 wells in the Eagle Ford basin (Railroad Commission 2015a) and that well-site conditions are similar between the Eagle Ford and the Barnett. Examples of the trucks that service wells can be seen in Figure 5. Quiroga et al (2015) found a direct correlation between the number of wells drilled on the Eagle Ford Shale and the degradation of local roads. This relationship was present despite maintenance spending on a per mile basis on Eagle Ford highways increasing by over 100% between the yearly averages of 2006-2009 and 2010-2013.

Figure 5: These truck trailers are used to transport water to the drill site for fracking. After fracking is complete, these trucks often carry "produced water" (also referred to as "saltwater") to injection wells or treatment sites. On average, seven to ten barrels of water are brought to the surface for every barrel of oil extracted (Guerra, Dahm, and Dundorf 2011). Each of these trailers can transport approximately 190 barrels of liquid per trip. (Photo courtesy of the author.)

In addition to the sheer number of trucks present on the roads, many times the wells are located in secluded areas of the county, where road conditions were already unmaintained reflecting the low-amount of expected traffic. This requires that truck drivers frequently drive over roads incapable of handling heavy loads. In doing so, the roads frequently deteriorate under the stress of the heavy vehicles, causing the emergence of dangerous potholes, damaged culverts, and weakened road edges.

Many respondents across the core Eagle Ford counties noted how the road situation has been impacting daily life. This issue was manifested from a local

development perspective, local governance perspective, as well as a general safety perspective:

> "His [the county judge's] biggest headache of this whole thing is roads. In these small cities and small counties, that's what gets the citizens most excited, and I think he would know.... And I think he's addressed it two or three times with the state to try and get more monies into these counties. Cause, the money we're getting... it's not possible to use the roads." (EFS002).

This consequence is not exclusive to the core production counties. Indeed, these problems extend into the peripheral counties—those counties that have only in the past four years started to experience Eagle Ford oil and gas drilling. "That's the one thing that the oil industry has brought here is getting our roads slapped up, and we only have 'x' number of dollars to put into our roads" (EFS014).

Local governments are relying on the state to provide increased funding to heavily impacted areas. Local lobbying efforts at the state level to fix the roads have had mixed results. The 2013 Texas Legislative Session passed a bill disbursing $225 million (Rahm, Fields, and Farmer [2015] cites this value as $450 million, but every source I found stated it was approximately $225 million.) to county governments to alleviate traffic concerns through County Energy Transportation Reinvestment Zones (CETRZ) managed by the Texas Department of Transportation (TXDOT) (Batheja 2013; Texas House of Representatives House Research Organization 2013). CETRZ funds were meant for Eagle Ford counties that were most distressed by the shale trucking industry. However, in practice, the money was widely distributed to nearly any county that filed an application for the funds (Miller 2015). Analysis of the 2013 program found that 70%

of the CETRZ funding went to the Eagle Ford (Hiller 2014). While helpful for cash-strapped county budgets, the amount was insufficient to properly repair damaged roads according to respondents. In several interviews, respondents indicated frustration with the CETRZ program. One respondent was particularly riled by the policy, believing that because his county had been one of the largest oil and gas producers in the region, it should be compensated accordingly to repair its roads. In essence, he sees his county sacrificing for the development of the region and the state:

> "The biggest thing is when the legislature appropriated $225 million last year [(2013)] for road repairs and it was supposed to be earmarked for the Eagle Ford Counties: the ones that were mainly affected, the ones that are donating, putting a lot of money into the Rainy Day Funds. We're producing a lot of money for the state too. Anyways, they setup a set of rules to apply for the money funding to build roads, country roads looked like that…When it came down to this first of the year in appropriations, they gave the money out to 191 counties instead of the 15 or 20 that they were supposed to" (EFS003).

The CETRZ program was mentioned in five interviews, always in a negative light. This discontent was expressed not only through the way in which money was distributed to all the counties but also how the amount was insufficient to properly manage the destroyed county roads buckling under weights of the trucks. Several respondents found the amounts doled out to their city coffers to be unreasonable given the degradation of the roads. "Last legislature, they gave us a couple hundred thousand dollars. It wasn't much. You can see what they appropriated for roads and shales, and if you spread it over the whole shale and the whole need, you might as well not have received anything really" (EFS001).

The CETRZ program was immediately followed up by a constitutional amendment passed by popular referendum allowing for the utilization of funds from the Economic Stabilization Fund (also referred to as the Rainy Day Fund) for transportation issues. It was anticipated that approximately $879 million would be immediately available for public statewide highways by September 2014. As drilling increased across the state and more tax receipts were brought in from oil and gas production, the money diverted from the Rainy Day Fund was expected to increase to $1.1 billion by September 2017. The majority of these funds are destined for state highways in urban areas and not the rural county roads that have been most destroyed by the drilling. Even if that money is disbursed to all the impacted roads, several respondents were suspicious of giving more money to TXDOT because of the perceived misallocation of CETRZ funds. One respondent went so far to call TXDOT as "a bunch of straight running idiots" (EFS003). Of the eight respondents indicating some form on tension between state and local governmental organizations, seven of them were relevant to road funding.

Beyond state investment programs, local governments have been looking for creative ways to help supplement road funds and bring more money to coffers without raising taxes. It is illegal in the state of Texas for counties to create an impact fee for road usage, but several respondents noted that they had approached oil and gas companies about making donations to the county to help with mitigating the damage costs. This topic was explored briefly in Tunstall (2015) and has been used by energy companies in other resource extraction zones. Haslam McKenzie (2013) discusses an

Australian example. Many times, however, the requested donation is nominal (only on the order of a few thousand dollars) in comparison to the damage to the roads:

> "The oil companies have been very good about working with the county for [donating] some [road] material. We have come up with an option for the oil companies that all oil companies… have taken up. Basically, they make an $8,000 donation towards the roads per well. It ain't much. They're doing $100,000 worth of damage" (EFS015).

This is seen as a stopgap measure to ensure that the government has enough money to repair the roads in the midst of the boom without raising taxes, especially considering there is a lag between the actual drilling of the well and the moment the county starts to receive tax receipts from that drilling. For instance, according to one respondent: "Even if it's completed in December 2015, then it's January-December 2016 that the evaluation is calculated upon. So then it's 2017 that you actually would begin to see the revenues" (EFS015). That lag time is more significant if the well is drilled at the beginning of a new year.

While small, one-time donations may help, as noted by the respondent, the damage to roads is generally far greater than donations may cover. For example, an analysis conducted by DeWitt County found that approximately $133,000 per well is required to upgrade and maintain the county road system that enables both energy industry and general public uses (Naismith Engineering, Inc. 2015). Nevertheless, donations are not the only method by which local governments are able to capture revenues for rebuilding roads. Due to an obscure 1960 opinion by then-Texas Attorney General William Wilson, all royalties gained from minerals interests under county roads

and right of ways are conveyed to the state general revenue fund (Blanchard 2014). One county official admitted to working with other local officials across the Eagle Ford Shale to lobby the Texas legislature to modify the law. These efforts were successful, and in June 2015 Governor Greg Abbott signed HB 2521, which forces any county road lease royalties to go into a special fund that is then disbursed back to the counties until September 2017. After 2017, any oil and gas leases that involve county road mineral property must be directly negotiated with county officials and the resulting revenues going directly into the county coffers (Coleman et al. 2015).

This issue is not just specific to the counties. Depending on the strength of the local ordinance structure, cities can impose drilling fees on wells drilled within the municipal limits (Fry 2013). These fees are intended to offset some of the negative ramifications of the well, such as increased supervising of drilling activity, restoration of the site after the well is plugged and abandoned, and repair of local roads. Typically, these fees are between $5,000 and $25,000 (Murphy 2014).

Several respondents also noted how the quality of the roads was not the only problem. Additional concerns (n = 4) rested with the quality of the drivers. One respondent lamented how the high demand for licensed truck drivers has impacted the safety of local roads: “We have a bunch of trucking companies, and they will hire you, get your [commercial driver’s license], and then you have a guy that has been driving an 18-wheeler for three months, who thinks he’s been driving it for 30 years. And he’s going 90 miles per hour down the highway with a full load” (EFS009). Compared with 2006-2009, there has been a 61% increase in crashes involving commercial vehicles on

the Eagle Ford Shale during 2010-2013 (Quiroga and Tsapakis 2015). One respondent was fearful how his child was going to cope with the oilfield traffic when she became of age to start driving. Four respondents expressed how rampant and available drugs are in south Texas, which has impacted the hiring practices of Eagle Ford truck driving companies. It is unknown whether drug use has been complicit in truck accidents. How drug use adversely affects local hiring practices will be explored in greater detail later in the section as an Eagle Ford workforce challenges.

Respondents were quick to note that these drivers are frequently overworked. Driver fatigue presents its own challenges, especially on relatively small country roads with significant traffic. This problem is exacerbated by the 24-hour nature of the oil and gas industry, in which the drilling then the subsequent fracking of a well rarely stops until its completion, unless dictated by municipal law or the unavailability of equipment or labor. Truck drivers are expected to be available to haul materials to and from the worksite. Trucking companies can counteract this fatigue through shift work distributed amongst employees. However, sole contractors must be on-call and prepared to haul materials at a moment's notice. Furthermore, according to respondents, drivers are paid based on the amount transported between locations and the time it takes to carry that load. Therefore, truck drivers frequently maximize or exceed the legal limits of their loads, while traveling at high speeds down roads and bridges that are incapable of handling their trucks. This was discussed in a NPR story that found 69% of trucks in Dimmit County were overweight (Fehling 2012). This presents a problem not only for

the condition of the roads but also for residents. The arrival of oil and gas activity has significantly increased the traffic to levels that residents find uncomfortable.

This section has examined the main infrastructure ramifications to boomtown development in south Texas. The boom, while brining economic development in the form of increased traffic, has also complicated regional development outcomes. Indeed, respondents indicated that budgets are consumed by infrastructure-related needs, thus limiting the amount of resources that can be spent on economic development incentives. Moreover, the increased traffic and road degradation has resulted in more traffic accidents. Finally, while there have been attempts to remedy the situation at the local and state level, respondents were adamant that not enough was being done, and that they were still experiencing negative economic development outcomes with the increased traffic. The degradation of the physical infrastructure and the inability for municipal and county governments to effectively manage road use has led to a social disruption: citizens are afraid to use the roads.

4.4 Housing: "There Is Nowhere to House the Family Here"

Many respondents mentioned how housing—both too much and too little—was (n = 5) the main inhibitor for future growth in their cities. In fact, after degradation of local roads, housing was the most mentioned development-related consequence of oil and gas exploration. Every respondent discussed housing unprompted, with many concerned about the lack of long-term housing or the over-abundance of short-to-medium stay accommodations. Equally important, most respondents cited possible tax and financial

benefits of allowing hotel-motel accommodations in the city and the secondary businesses, such as restaurants and shopping centers, that workers support.

Drive-in, drive-out (DIDO)—a method of long distance commuting (LDC)—appears to be one of the normative forms of labor management on the Eagle Ford Shale. This form of LDC is not a requisite of boomtown development: "Rapid population growth is a function of both the size and composition of the in-migrant workforce, but also the size of the population of the host community" (Jacquet 2014, 8323). In the DIDO mode of labor production, workers arrive and work in the shale play for a period of consecutive days or weeks, then return back to their homes—typically outside the play. In the case of the Eagle Ford Shale, many of these workers are likely driving from large Texas metropolitan centers (e.g., Houston, Dallas-Fort Worth, San Antonio) or from the Permian Basin, which has historically been the epicenter of on-shore oil and gas drilling in the state. Interestingly, there is a dearth of literature on DIDO in the U.S., despite the increasing usage of such labor schemes in developing shale plays. Often the perceived growth in boomtowns (see Jacquet 2014; Tunstall 2015a) is overshadowed by the large numbers of workers in the region only temporarily. However, much of the research on DIDO (and fly-in, fly-out) is focused on the mining sector in Australia where workers are either driven or flown to worksites at the company's expense (Storey 2001; Perry and Rowe 2015).

Similar to the Australian experience, Eagle Ford energy workers, who live outside the shale play, are unable to move into Eagle Ford region because of insufficient housing (Murphy 2015b). High demand for homes, properties, and mineral estates has

caused land values to spike across the Eagle Ford as workers rushed to the region in 2010-2014. With nowhere to go, workers were forced to find alternative accommodations in short and extended-stay housing. However, those resources were quickly exhausted. Cotulla, a town of 3,000 people to the southwest of San Antonio, has famously grown from three hotels in 2008 to 26 hotels, motels, and extended-stays today, with several more still under construction or consideration (Buchele 2015). While the Cotulla example is extreme, this activity is not unusual across the Eagle Ford, especially in the core production counties where small ranching and farming towns were unprepared for the onslaught of energy workers moving into the region.

This is not to say that short-to-medium stay accommodations have been the only way these towns are attempting to accommodate that growth. Towns have been trying to bring RV parks and unconventional accommodations that can decrease the pressure on the local housing market. Self-described "man camps" are popular in oil and gas boomtowns (White 2012). Man camps can take a variety of forms from little more than a RV park (Figure 6) to more substantial modular, quasi-permanent structures (Figure 7).

Figure 6: This is a lower quality example of a man camp found in Big Wells (2010 census population: 697 people), Texas.
(Photo courtesy of the author.)

Figure 7: This is a higher quality example of man camp just outside of Three Rivers (2010 census population: 1,848), Texas.
This particular man camp boasts amenities such as complementary breakfasts, a fitness room, and a small convenience store. (Photo courtesy of the author.)

Housing and attracting workers to the region, who optimally would stay for an extended period of time, was a topic of frequent conversation with respondents. One respondent noted, "the reason why these people aren't brining their families here is because there is nowhere to house the family here. Or it is so expensive" (EFS005). Another mentioned: "[I]f you try to recruit people from outside the area, the biggest complaint is that, 'We can't afford to live there'…. You could have rented a house here for $250, $350 a month six or seven years ago. The same house today, if they'll rent it to you, will lease… for $1,200, $1,400" (EFS002). This was reiterated even on the periphery of the play: "That's our biggest weakness: …[we have] the lowest

unemployment rate and no housing to go with that" (EFS010). Furthermore, municipal leaders have the ability to influence this development. As mentioned earlier, cities have the ability to implement regulations to help slow development through zoning laws (EFS007), or, alternatively, they can help streamline the permit and construction process: "On the hotel, motel business, apartments, and single family housing… the city has had to work with some of those developers on some issues" (EFS006).

Furthermore, economic development officials have attempted to entice permanent housing developers to the region, many times to no avail, because the "initial costs of land are high so it drives the square footage costs to build and then [developers have to] import materials and import the labor" (EFS003). All of this is to state that property values in the midst of the boom were high. To demonstrate this, in 2010 bonus payments were between $1,000 and $4,000 an acre, which "in many cases outpac[ed] the surface value of the land" (Hiller 2010). By 2013, small surface properties were being sold for $7,159 per acre on average (Armijo 2014). A respondent corroborated this: "When you go to buy housing here in [EFS010's town], it's so high because [they think,] 'we have a potential oil well under here!'" (EFS010). To help combat this high demand for housing, some Eagle Ford municipalities sought to redevelop areas in the center of town that could help capture some population growth. For example, loft apartments were being offered in a converted movie theater in Kenedy—a small town of 3,000 people to the southeast of San Antonio (Figure 8). During interviews, officials at two municipalities discussed redeveloping or building new apartments: "[Local developers are] building a new apartment complex, which we haven't had apartments built since the

80's probably" (EFS009). "[The apartments] were probably built in the first oil boom" (Office manager of EFS009). This was reiterated by: "These oilfield guys they get tired of living in those mobile units. They want something little more permanent. So, the apartments complexes are important to them too" (EFS008).

Figure 8: A movie theater in Kenedy (2010 census population: 3,296), Texas, constructed between the 1930s and 1950s.
In 2014, it was converted into loft apartments ranging in price from $1,000 (1 bedroom, 1 bath) to $2,800 (2 bedrooms, 2 baths) per month (Baker 2014). (Photo courtesy of the author.)

High housing demand was an equally strong point of contention during previous energy booms. During the 1970s and 80s, entrepreneurs converted unused oil storage

tanks into small, single bedroom homes in Giddings (Hurt III 1981; Pirtle 2011) while Cotulla's leaders pushed for hotel construction (Buchele 2015). Similar stories from previous oil booms filled my conversations with certain stakeholders, who were eager to share how their towns responded to the surge in demand for housing. A respondent in different city noted that housing was especially tight: "in 1980 … people lived in tank cars" (EFS011). EFS010 added, "People slept on the parks, on the streets."

The short to extended-stay boom in housing has manifested itself in certain benefits for the municipality. Even in the midst of the bust in petroleum prices, many hotel-motel owners have been able to fill their rooms and make hundreds of thousands of dollars in the first quarter of 2015 (EFS012). Several of the strategically positioned larger hotels on the Eagle Ford Shale have made over $1.2 million based on tax receipts during this same time frame (Chapa 2015).

Municipalities receive hotel-motel occupancy taxes, which are usually shared between the city and any economic development agencies in the city. "The business [the energy industry has] brought to town just in motel-hotel taxes, which [our organization] gets a portion of… the city distributed, however they feel like they want to and we receive our fair share. Hotel-motel taxes have gone from 100 thousand dollars to over a million dollars!" (EFS008). Depending on the regulations in place to monitor and disburse the tax revenue, this money can be used by both the city and the economic development organizations to improve municipal services and the visibility of economic development in the city. Municipal economic development agencies use this money to attract new development to the city—typically through advertisements—however at least

two surveyed municipalities were using the money to build industrial parks. In a meeting in August 2014, a group of civic leaders on the western portion of the play discussed how to use this money. Ideas that were considered included a new electronic billboard to attract interstate travelers to downtown, the construction of a municipal golf course, improving the city landscaping, increasing the city's internet connectivity, and attracting new events (e.g., rodeo, firearms shows, motocross). In fall 2015, a newly constructed electronic billboard was enticing travelers to visit the city's historic downtown.

Although the short to extended-stay attraction of workers to the region is a boom for hotel owners and municipal economic development agencies, many officials wished to discuss how the increased sales tax influenced their economic development. The presence of these workers brings opportunities for increased sales tax revenue. While this revenue can come from a variety of locations, local government officials (n = 9) were quick to point out the perceived correlation between housing more industry workers and increasing sales tax revenue. This sales tax revenue is not restricted to the municipalities: "In the past [the counties] were lucky to have sales tax returns of $40,000 or $45,000 a month. Well, now they are over $500,000" (EFS006). This sentiment was reiterated frequently: "We also get a very small percentage of sales tax—so the more people that you have in here that are dealing with oil and gas activities, the more things they're buying, the more groceries, the more gas, and the more of everything else" (EFS014). This injection into the local economy proved to be a boom for local organizations. That money can be used to help mitigate some of the negative

ramifications of the energy development such as infrastructure degradation and insufficient law enforcement capacities in light of population increases.

While it is easy to couch the housing development of a region in purely positive terms, the reality is much more complex, according to economic development officials. Reasons for not sanctioning the construction of hotel and motels and not realizing potential tax revenues are complex. For example, two respondents reported that they were fearful of overbuilding: "We have also been reluctant to overbuild because it does, it's great while it lasts, but when they all pull out and there's no end, you don't know where end date is going to be" (EFS010). Several decades ago, Cotulla capitalized on a nearby resource boom and built a few hotels to accommodate energy workers. Many of those original-boom hotel-motel properties are now reporter-described bat houses (Buchele 2015).

Local governments—municipalities in particular—choose whether to take advantage of oil and gas related development and build short-to-medium stay housing through the permitting process. As mentioned previously, this type of development has inherent risks, not the least of which is the possibility of abandonment in the event of a bust in commodity prices. While such conversation would have been unheard of in the summer of 2014, municipalities are, as of early 2015, becoming increasingly concerned about the potential hurdles associated with keeping energy-related development housing in these municipalities.

While the fears of overdevelopment are present among respondents, they were also aware that every worker who is forced into short-to-extended stay housing is a lost

potential permanent resident. Indeed, economic development actors knew that without permanent housing, workers were more likely to leave the region once drilling had concluded. Seven respondents believed that if there was more permanent housing, then workers were more likely to bring their families and become permanent residents of the region—even if there was a significant cutback in energy prices: "They're [(oil and gas well maintenance workers)] going be our long-term families! And again, it goes back to the housing. More houses isn't [*sic*] going to be built until maybe the price of land drops—the square footage cost—because it's too high right now" (EFS003).

Beyond the lost opportunities for cities and potential residents, high housing costs adversely affects families already in the area—especially those on fixed or limited incomes. Economic development officials were cognizant that increasing housing costs were straining families who rented from property owners. Those families who find themselves in an unaffordable rent situation must either negotiate with the owner or abandon the property. One respondent in the core of the play best described the problem: "It's [the] rental rates; rent rates for housing have gone up significantly! And that does create a problem for people who have rented the house for a number of years; all of a sudden the rates have gone up" (EFS006). These now-homeless are unable to afford to live in the region and must seek employment and residency elsewhere. Weber et al. (2014) found a similar situation on the Bakken Shale, where social services are strained to track the constant flux of homeless individuals into and out of the region as the oil and gas boom develops.

The exceptionally high cost of housing is also a strain on businesses that find it

impossible to retain employees. Businesses typically have some capacity to raise employee's salaries or provide company housing to ensure that there is appropriate staffing. Alternatively, government agencies need employees to continue to operate yet do not have the financial capacity to sufficiently increase wages to offset sudden increases in the cost of living. Schools were of particular concern for respondents. Already under pressure from increased enrollment, schools were unable to retain teachers and staff, according to respondents. This problem is especially acute because formerly cash-strapped schools are flush with oil-related tax revenue yet are unable to spend it. Texas operates under the "Robin Hood" school funding system, which forces schools with budget surpluses to send money to the state that then disburses those funds to financially disadvantaged districts (Smith 2011). Many school districts that were once recipients of the Robin Hood Plan in south Texas have found their newfound wealth being recaptured by the state. For example, an Eagle Ford school district, once a recipient of Robin Hood funds, sent $51 million to the state and was only able to retain $19 million, according to the superintendent at a chamber of commerce meeting in August of 2014.

It is within this institutional setting that many schools find themselves unable to pay new employees enough to find housing in the region. "We need a place to put school teachers. I mean we've got money to hire good teachers, but you've got to have a place for them to live…. [The superintendent] had a lady that came down and signed up and resigned the next day, two or three days later, cause she couldn't find a place to live" (EFS003). EFS003 gave similar accounts that the United States Border Patrol and even

fast food establishments were having difficulty retaining workers due to the shortage of available housing. According to conversations with school district leadership, the problem has grown so severe that a portion of a 2014 $50 million bond package for the Cotulla Independent School District (ISD) was allocated to build housing for faculty and staff. Similar bond proposals, with allocated money for faculty and staff housing, were passed in 2014 in nearby Three Rivers ISD (Three Rivers Independent School District 2014) and McMullen County ISD (McMullen County Independent School District 2014).

While previous wage studies have indicated that counties that have oil and gas production are likely to have an increase in nominal wages (Weber 2012; Haggerty et al. 2014; Tunstall et al. 2014; Tunstall 2015b), the reality is much more complex, especially if there is no housing to capture new workers to the region. The lack of permanent housing, therefore, becomes one of the integral aspects of the problem triangle. Without adequate permanent housing to accommodate oil and gas workers, they fail to integrate into the communities and disrupt the sense of community (i.e., the quality of life) experienced by locals.

4.5 Workforce and Wages: "You've Got to Pay Them to Retain Them"

In addition to road impacts and a shortage of housing, Eagle Ford respondents also discussed the disruption of the traditional wage profile of the region. The explosion of energy-related activity has resulted in over $2.7 billion in estimated wages paid to oil and gas employees who work on the Eagle Ford Shale in 2013 alone; energy extraction

further resulted in $1.5 billion in wages paid to employees indirectly associated with the oil and gas industry (Tunstall et al. 2014). With workers and labor in high demand during the height of the Eagle Ford Shale boom, many oil and gas companies were forced to raise wages to levels well beyond previous regional norms. This is especially important when put in the context of regional economic decline leading into the boom (Tunstall 2015a). Many individuals adversely affected by the 2008 Great Recession found work in the oil and gas industry (Phillips and Cañas 2011). However, as the boom overtook the region, wages rose as the demand for workers increased: "The problem is retaining people…. If you've got somebody good, you've got to pay them to retain them, otherwise they'll go work for oil and gas or associated industry" (EFS003). Several respondents (n = 7) in the core of the play noted that the minimum wage had naturally risen in their regions to over $12 per hour, with many firms still struggling to find enough workers: "The biggest impact probably is that obviously the businesses we have in town all have the same complaint: They can't get enough employees" (EFS002). Previous wage studies have indicated that counties that have oil and gas production are likely to have an increase in nominal wages (Weber 2012); however, the reality is much more complex, especially if there is no housing to capture them. Local government agencies, whose functionality is dependent on having adequate employment, are most negatively affected by the disruption of wages.

Many of the Eagle Ford energy jobs, despite being physically demanding, do not require post-high school education. When asked about education, nine respondents noted that the majority of Eagle Ford energy careers only require a high school education.

There was one anecdote of a pipeline company hiring "a bunch of the high school kids for the summer to go out and work as helpers, welder's helpers. And I think they were paying them $17.50 an hour" (EFS002). Hardly unique, compensation for individuals with a high school degree during the midst of the boom could easily exceed $20 an hour with opportunities to receive performance-based (and market-based) bonuses according to respondents: "Anyone who can sling a sledgehammer can make $15-$25 an hour, literally" (EFS010).

High demand for employment has forced the oil and gas industry to seek labor from beyond the Eagle Ford Shale. Often, work on the play is organized through DIDO arrangements. When asked, many respondents assumed that energy companies were hiring from a variety of locations, both locally and beyond the play:

> "[Oil and gas firms] are hiring a lot of the locals—giving locals jobs—but as well is a lot of this oil field companies are not just located in [the respondent's municipality]. So they're having the people that work in their main offices come down, train the people maybe from throughout here in the area, and then they'll go back and they'll have it under control here" (EFS005).

Even with a sizable population coming from outside the region, many respondents were quick to suggest that oil and gas development, or more specifically, the labor, was not an important driver of economic development. Despite workers using local hotel-motel accommodations, one respondent likened the oil and gas industry to a military base, where the workers largely live independent of the municipality that is hosting them (EFS013). Another interviewee noted that in his city, "There's 8,500 [people] before the Eagle Ford [boom] and they all had jobs" (EFS009). This finding

relates to work conducted on the New Albany Shale in which local policymakers responding to a survey were concerned that the decreasing population would deter energy companies from moving to the region (Crowe et al. 2015). In the Eagle Ford, however, energy firms were still eager to take advantage of the resource, even if that meant bringing in their own workers from beyond the shale play.

Adding to the complex nature of the labor on the Eagle Ford is the high mobility. Three respondents said that oil and gas workers would "jump [from one firm to another] for 50 cents [per hour pay increase]." Economic development officials complained that they were unable to retain labor: "we lost three or four deputies [in the county police force] to the oil industry, because it paid so much better. And so, when you only have 12 deputies, that's 25% of your law enforcement workforce" (EFS015). Similar accounts came from both the core and the peripheral areas of the play, where local government and civic organizations lacked the financial means to attract labor away from the oil and gas industry. This has resulted in shortages of police, road workers, public health officials, teachers, coaches, just to name a few.

Higher wages, however, have not been experienced evenly across the shale play. Indeed, there are certain sectors of the workforce that have been unable to obtain higher wages because of the social circumstances of the region:

> "[The energy companies] hire anybody that pass in a drug test! And that becomes a problem, because we live in a community that has been economically distressed for many years…. I'm talking about somebody that's in high school or lower who can't really envision some future endeavor for them to participate in or to have an opportunity to build a future—generally falls into the realm of somebody that has no direction, and they are most susceptible to getting involved

> to drugs or to things that impact their lives in the future. They have no idea that these things are going to affect them at the time that they do them" (EFS007).

Here EFS007 is touching on a subject that has been well documented in the scientific literature. Youth in rural settings are statistically more likely to partake in drugs compared to their urban counterparts (Lambert, Gale, and Hartley 2008; Pruitt 2008; Coomber et al. 2011). If that individual is caught, drug use can have consequences for future employment opportunities and can restrict their ability to participate in the energy economy. Relevant to this discussion, these decisions can result in significantly lower wages. Without being prompted, four respondents discussed the south Texas drug culture—both how the region is a major gateway for illicit drugs and how it was impacting the hiring practices of energy firms. EFS007 went on to demonstrate the severity of this issue:

> "This [energy firm recruiter] told me that they interviewed—I don't know how many people. 100 didn't pass. In the end they eliminated, I want to say, like 70 guys on the drug test. So, they only had 30 guys left. 30% of the work force was available. So, they ended up moving closer to San Antonio where they had a larger pool [of workers to select from]" (EFS007).

While I will not delve into the Eagle Ford substance abuse dynamics from a public health perspective, it is important to recognize the economic development implications. If firms do not locate in the region because the workforce is already strained by strong demand, substance abuse may limit employment. Regional development driven by DIDO regimes do not have the same positive magnitude of economic impact as more traditional development (Storey 2001). Consequently, every

potential local worker removed from the workforce is another worker that must be brought from beyond the shale play who has a smaller economic development influences.

The nature of workforce challenges creates particular constraints on use of public resources. Economic development agencies, in the beginning of the boom, were overwhelmed with responsibilities. Furthermore, many offices were understaffed because of the financial structure of government institutions on the shale play discussed earlier. Many agencies decided to use the resources by hiring employees—even at exceptionally high salaries. While perhaps this is a requisite response given the demands on municipal and county agencies, the newly created positions are only sustainable insofar as energy prices remain elevated and the regional development does not slow. One respondent summarized it best:

> "Some of our brethren in south Texas decided they'd put a bunch of people to work, but these mineral taxes are cyclical, and so, none of them are permanent. The value of the well today first drilled is as high as it will ever be. It will only go down from there and eventually die to zero" (EFS015).

Alternatively, respondents discussed using money derived from energy development to invest in improvement projects or to save for when the boom in development starts to decline. These projects can come in the form of new equipment for government offices, new facilities (i.e., capital projects), or temporarily decreasing the tax rate.

> "In anticipation of using [oil and gas mineral estate taxes], you want to be responsible with them. And so, that's one of the things we're doing with the capital project…. That was one thing that we made sure of is that the revenue streams that we have today would cover the note for that, because it is being financed" (EFS015).

Similar capital improvement projects, such as courthouse expansion or renovation, are taking place in the core of the play in Karnes County (Fisher Heck Architects 2015) and Live Oak County (Naber 2013).

In this way, wages are an integral aspect of the Gilmore (1976) problem triangle and social disruption hypothesis. Admittedly higher wages are generally perceived to be a good ramification of Eagle Ford development. These higher wages—while potentially beneficial for individuals who were ready to work in the oil and gas industry—were a major hindrance for firms that did not have the capacity to raise wages. If the government and non-energy businesses are unable to retain workers, higher wages leads to a disruption in local services, which then results in a disrupted quality of life. This connection will be described in greater detail in Section 4.7.

4.6 Mineral Wealth: "Everybody Wants an Oil Well"

The final section of the interview instrument queried the perceived amount of absentee versus local mineral ownership. Economic development stakeholders were divided whether mineral ownership is more local or absentee. As one respondents said, "I think everybody wants an oil well in their backyard, and if they could attract that, then they would" (EFS010), suggesting that surface ownership entailed mineral ownership. Other interviewees were skeptical whether mineral owners resided in the county. One

respondent said, “I think some people sold land recently who [also] sold their mineral rights, and said: ‘Yeah, give me a hundred dollars more and I’ll sell you the mineral rights….’ [The Eagle Ford Shale boom] happens a year later, and you go, ‘Oh shit’” (EFS007).

Many respondents were aware that mineral estates have become increasingly fractional, giving some explanation as to why there are so many small mineral royalty holders. This happens in a variety of avenues: selling a division of the mineral estate during the sale of the surface property to attract a buyer, retaining the mineral estate while selling the surface property and it fragmenting through generations of ownership, mineral owners selling part of their estate to property acquisition companies to shore up personal finances, and other ways. Even prior to the start of the boom, property sellers rarely sold the mineral estate. As one real estate agent put it: “I haven’t sold a property with mineral rights really since before [2003]” (EFS003).

This issue becomes more complicated when landowners sell their subsurface water rights. As with mineral rights, water rights can be severed and exercised. As one official puts it, this creates an awkward situation in which “land speculators came in; they bought the land with all the rights, stripped all of [rights] from under it, and sold the dirt [i.e., the surface property]” (EFS015). Even in these situations, the mineral estate still holds supremacy, and through Texas law, the mineral owner can use as much water as is necessary for the drilling of the well (i.e., while the drilling rig is in place). However, in order to frack a well, the rig must be moved, and in these cases, the mineral owner or lessee must negotiate a contract directly with the water rights owner (EFS015).

4.7 Reconciling Gilmore to Modern Hydrocarbon Drilling

Complex economic development paradigms in the Eagle Ford Shale emerge in response to the three major ramifications of the play: 1) infrastructure management, 2) deficient housing, and 3) workforce/wage failures. This complexity is temporal and spatial with many objectives shifting over time as the play has also developed. Broad conclusions can be made about the typologies of economic development styles on the Eagle Ford (Table 4) and the amount to which locals have been able to retain their mineral rights.

The pursuit of economic development goals does not occur in a vacuum. Municipal and county governments react to the shifting paradigm based on perceived needs and objectives. Economic stakeholders were quick to establish how their municipality's economic development style was different than a nearby city. Municipalities and counties communicate and coexist, yet are also in inter-jurisdictional competition with neighboring local governments for investments, labor, and tax revenue. For a review of inter-jurisdictional competition, refer to Harrison (1997).

4.7.1 Why a New Triangle?

Gilmore's (1976) problem triangle predicted how the negative ramifications of boom development influence economic development (Figure 2). Gilmore believed that towns were most disrupted when boom conditions ensued and local services fall short of need. This decrease in social services is what causes an unstable labor supply. This unstable

labor supply forces old industries to consider leaving and potential new industries to reconsider moving to the area. This, in turn, creates a degraded quality of life.

Gilmore's 40 years old triangle can be reconciled to a modern context to encapsulate the issues that present-day development officials confront. The problem triangle is still relevant; however the dynamics of resource extraction have changed and updates are needed to the triangle. Furthermore, the materiality of oil and its associated capital markets are markedly different from the hard rock mining that Gilmore discusses requiring that the triangle be updated from its present form. Like hard rock mining, a very large workforce is required when a hydrocarbon well is first drilled. However, unlike hard rock mining or even tar sand oil extraction (Pasqualetti 2009; Keough 2015), shale petroleum production only requires a large number of workers be at the site for three to four weeks per well and a minimal workforce to maintain the well. This materiality, in turn, makes the shock of drilling resource mobilization to a play more dramatic. Yet, once the drilling of new wells slows, the region witnesses a major exodus of men and materials from the play. Long term linkages between a locality and the oil and gas industry takes decades to develop and is most concretized when downstream processing plants are built in a community (Freudenburg and Gramling 1998). Otherwise, any linkage is likely to be tenuous. Additionally, lower capital costs and surmountable barriers to market entry allow for quicker project initiation (Bridge 2008) relative to Gilmore's hard rock mining industries. Finally, while hard rock mining remains an important component of the U.S. economy, oil and natural gas production—in lieu of coal production—has been targeted by policymakers as important for the

United States energy economy and will likely be pursued for the foreseeable future. Therefore, it is time for the triangle to be updated to the modern realities of oil and gas drilling.

4.7.2 A New Problem Triangle

In my new version of the Gilmore triangle, I note that increased resource extraction first leads to a strain of the local labor market (Figure 9). Once the local labor market is exhausted, which occurred within the starting years on the Eagle Ford, labor is brought in from beyond the region in DIDO arrangements, especially in those locations with limited housing. The high demand on the labor market and straining wages make it difficult for non-energy businesses and government services to be fully staffed, leading to a decrease in productivity. For municipal and county governments, this problem is compounded by the lag between the time services are demanded and the time taxes are assessed (Section 4.3). In this way, municipal and county governments as well as business services fall short together, leading to inadequate goods and services for local residents and temporary workers. This leads to a *disruption* to the quality of life of residents. As long as the resource extraction increases, the triangle will continue, however if resource extraction slows, then the problems will slowly ameliorate through the boom-bust-recovery process (Brown, Dorins, and Krannich 2005).

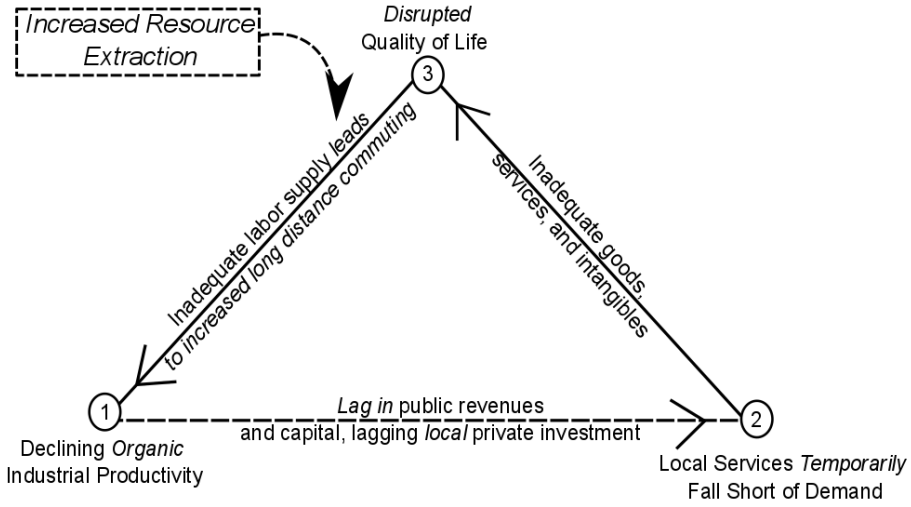

Figure 9: The Gilmore (1976) problem triangle envisioned in a modern context. My changes are in *italics*.

I have made the following modifications to the Gilmore (1976) problem triangle to bring it into a modern context. First, I added the stimulus that causes the triangle: increasing resource extraction. Second, I changed the numbering to reflect how productivity is negatively impacted first, not quality of life. Third, I noted that the inadequacies associated with the labor supply are largely local and lead to increased LDC, as noted by the literature (Storey 2001; Aroca and Atienza 2011). Fourth, I note that local (what I term as "organic") industrial productivity begins to decline due to an inadequate local labor supply. Because of the demand on local labor, local non-energy firms have difficulty competing with the energy industry because of the increasing wages. Fifth, Gilmore wrote that there are inadequate public revenues; however, my conversations with economic development officials indicate that there is a *lag* in public revenues that may take several years to correct. Finally, given that there is a *lag* in public

revenues, local services *temporarily* fall short of demand. This leads to a disrupted quality of life, not a permanently degraded quality of life as implied by the Gilmore triangle.

Based on the literature discussed in Section 2 and the sentiment of hydrocarbon development discussed by respondents, the present triangle is meant to be less pessimistic than Gilmore's triangle. Gilmore also indicated that this situation was more or less permanent. The boomtown literature instead argues that resource towns go through boom, busts, *and recovery* after a certain amount of time (Smith, Krannich, and Hunter 2001; Brown, Dorins, and Krannich 2005). Consequently, whereas resource extraction has positive and negative consequences on the economic stability of a city, it does not permanently alter it—even if most energy firms are only present for the duration of the boom. Economic development officials noted that the rapid and ongoing development of resource extraction is the major inhibitor to economic development, not necessarily the failing of local organizations as indicated in Gilmore's triangle. This is a product of the materiality of oil and gas extraction versus hard rock mining. Hard rock mining requires a long-term workforce to stay local to the mining site. Oil and gas, on the other hand, only requires a minimal workforce after the well has been drilled.

These changes are not meant to be a fundamental shift to Gilmore's triangle; rather I am reconciling it with the modern realities of oil and gas drilling. There is no doubt that today's oil and gas extraction is intrinsically different from the Colorado hard rock mining Gilmore studied 40 years ago. We have more data about boomtown governments and how they react to the arrival resource extraction. We have more data

about economic outcomes in boomtowns. We have more data about the nature of resource extraction firms, how they operate, and how they are financed. Therefore, it is important to reconcile the theoretical foundation of boomtowns to their modern realities, especially considering the possibility for more boomtowns with the shale revolution.

4.8 Conclusion

This section has discussed the major policy domains that boomtown economic officials operate within when mitigating the negative externalities associated with explosive development. I offered two approaches to mitigating the negative externalities associated with boomtown development. As determined through a grounded approach to coding of interview transcripts, local policymakers were most upset about road degradation, a mismatch in housing availability, and skyrocketing wages paralyzing local, non-energy businesses as well as municipal and county governments. Additionally, I have demonstrated how stakeholders perceive of absentee versus local mineral ownership. Finally, I have updated Gilmore's (1976) problem triangle using the literature published in the 40 years since Gilmore published his *Science* article and reconciling it to the modern realities of oil and gas development, which is very different from the hard rock mining Gilmore studied in the 1970s. This triangle has explanatory power that can be used in other situation of resource development as well as a pedagogical tool to help describe how boomtowns respond to the pressures of oil and gas development.

Finally, it is worth reiterating that a small number of economic leaders resolve the development style of a local agency. Municipal policymakers determine the

governance style of an organization for small spatial subsets of the Eagle Ford Shale, especially relative the size of the resource. These decisions are also potentially small in temporal scale, with many policymakers only remaining in power a set term or series of terms, while the life of the hydrocarbon play will be several decades. Notwithstanding the limitations, these policy decisions may have profound shock of the fabric of a government agency and how that municipality's or county's leaders negotiate boom-related ramifications. As economic development policymakers become aware and react to the consequences of the hydrocarbon-based development, they tailor policies to their jurisdictions that then manifest as different governance styles (demonstrated in Table 4).

5. LIVE OAK COUNTY MINERAL WEALTH CONCENTRATIONS

5.1 Introduction

In this section, I analyze publically available Live Oak County Appraisal District (LOCAD) data to determine the spatial variability of mineral interest holdings, the main beneficiaries of assessed wealth, and the relative concentration of mineral wealth. I use the appraised value of mineral interest ownership and holdings as a proxy for relative mineral wealth. As discussed in Sections 2 and 3, mineral estates have established ownership regimes that can operate independently from the surface estate. These estates can be bought and sold in a similar fashion to surface estates; however unlike surface estates, large amounts of labor and capital are required for the estate to become productive especially in unconventional plays.

From an appraisal perspective, it is very difficult to assess the value of a mineral estate prior to the initiation of production. Therefore, mineral estates are only taxed once well production is established and reported to the RRC. The amount of mineral wealth that is taxed is debatable, because it is difficult to know with absolute certainty how an oil or gas well will perform over several years or decades. However, the methodology used by LOCAD and other appraisal districts is consistent, and the aim of this study to examine the *relative* spatial and non-spatial concentrations in wealth. The absolute amounts of mineral wealth are not as important and may vary depending on the market price of oil. These appraised values are essential to the financial health of oil and gas companies, especially upstream operators whose company valuations are derived from

the leased mineral estates. These leased mineral estates also serve as collateral for loans to commence drilling wells.

I use the methods established in Fry, Briggle, and Kincaid (2015) and Brannstrom, et al. (2015). To summarize, I processed the LOCAD data then uploaded the data into ArcGIS to examine the relative spatial variability and concentration of appraised mineral wealth. This is demonstrated via several statistical tests, the results of which will be shown in the latter half of the section. While I focus on data from 2015 (see Section 3 for reasoning), I also examine some of the chronological aspects of these data. Finally, I offer some concluding thoughts on the data.

5.2 Overview of Live Oak County Mineral Wealth

Live Oak County is in the southern portion of the play (Figure 10) and is a representative county in terms of hydrocarbon production. According to the EIA, the Eagle Ford only extends through the northern and central part of the county; nevertheless, oil and gas production takes place over much of the county (Figure 11). Oil was first discovered in Live Oak County in 1930. Annual production reached nearly 400,000 barrels by the end of 1940 (Hester 1996). By the 1950s, ranching started to supplant farming as the main economic driver of the county and the excess labor went into uranium mining and the oil and gas industry. In 1984, annual oil production was nearly 4,000,000 barrels. As oil, gas, and uranium production diminished through the 1990s because of decreasing reserves, the population fluctuated around 9,500 people (Hester 1996). Since the 1990s, the county has experienced modest growth, and today has about 11,500 people. In June 2015, 26,600 barrels of oil and 322,440 mcf (thousand

cubic feet) of gas were produced in the county *per day* (Texas Drilling 2015). The county has two incorporated cities, Three Rivers (2010 population, 1,848) and George West, the county seat (2010 population, 2,445).

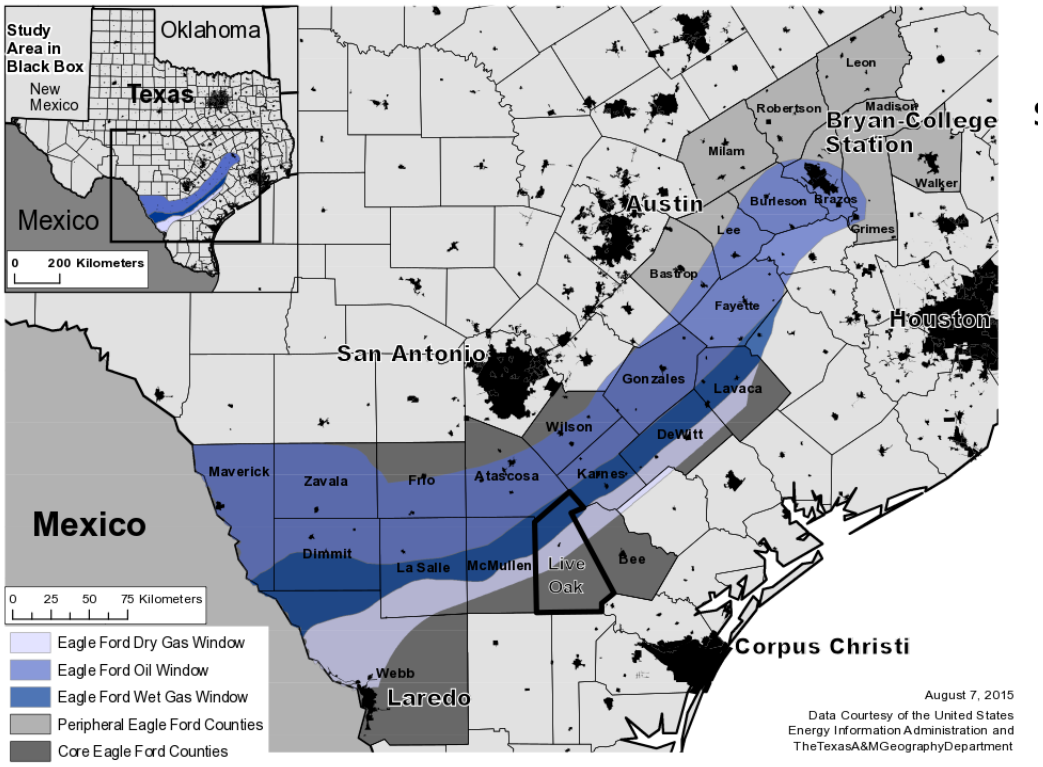

Figure 10: Overview Eagle Ford map with Live Oak County outlined.

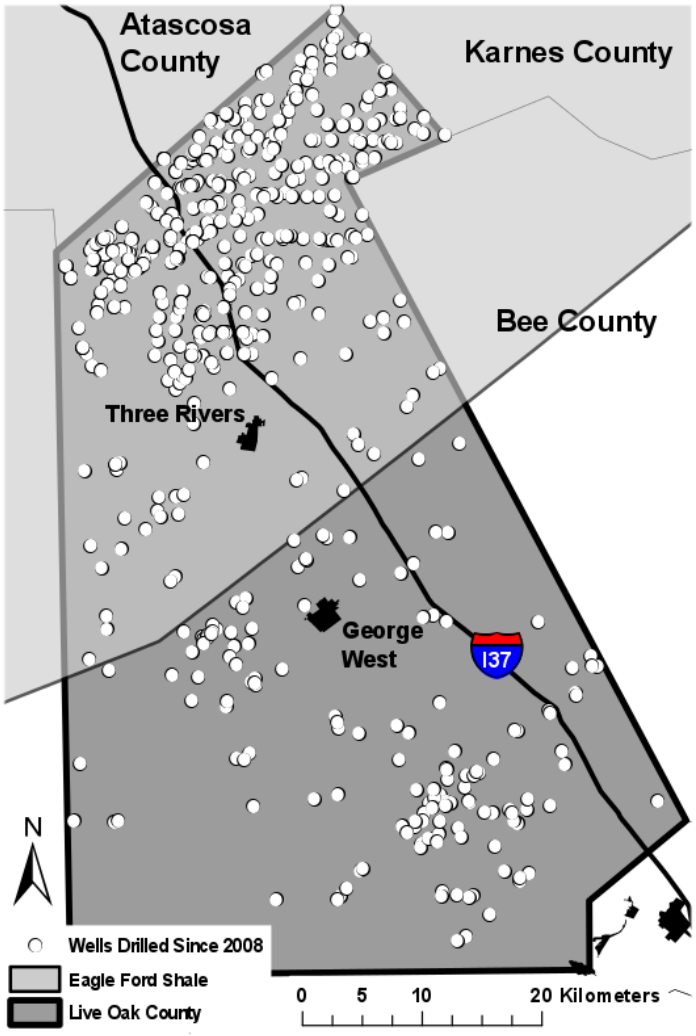

Figure 11: Map of Live Oak County indicating the location of the two major cities and the locations of oil and gas wells drilled since 2008.
(Well data provided by Railroad Commission 2015a and the Texas A&M Geography Department.)

Live Oak County sits on the southern edge of the Eagle Ford Shale yet is still considered a core production county by Tunstall et al. (2014) and Rahm et al. (2015). Scientists at UTSA have calculated the 2013 economic output of the county at $6.95 billion (Tunstall et al. 2014). Using the methods described earlier, summing all forms of appraised

mineral interests, there is $1.362 billion in total appraised mineral value (Table 5).

Mineral wealth distribution is strongly negative skewed (Figure 12).

Table 5: Economic statistics about Live Oak County.

Live Oak County	
Hydrocarbon Materiality	Condensates and Dry Gas
Number of Wells	752
UTSA Estimated 2013 County Economic Output	$6.95 Billion
Total 2015 Appraised Value of Minerals	$1,362,631,225

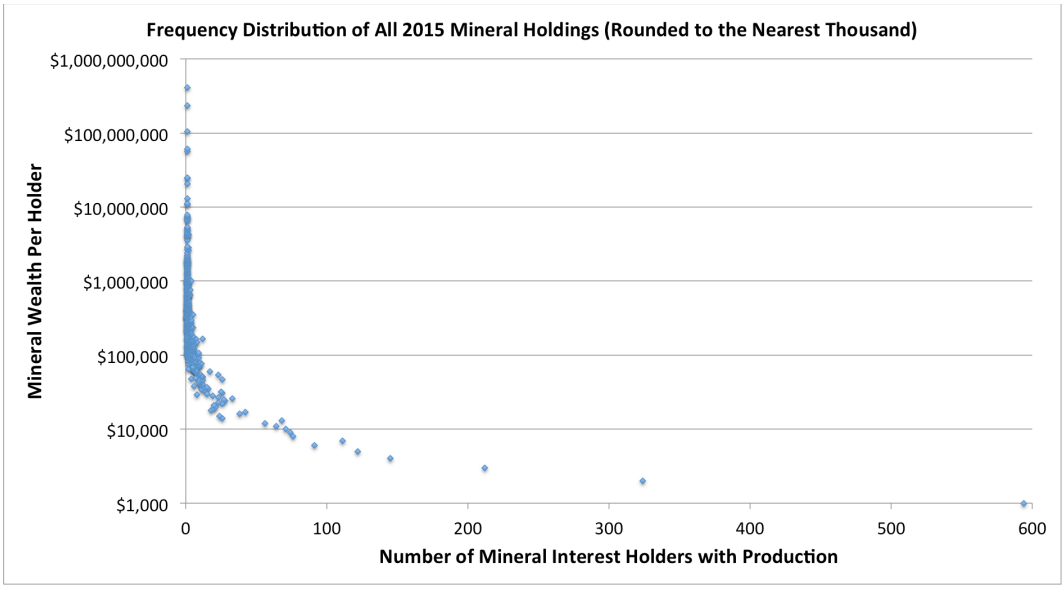

Figure 12: The frequency distribution of 2015 Live Oak County mineral wealth. Note: the y-axis is logarithmic.

5.3 Mineral Wealth Examined on an Interest-by-Interest Basis

Working interests—which represent the firms that have the largest interest stake in the well but are also responsible for the costs of drilling, operations, and environmental cleanup at well abandonment—account for 69.73% ($950,103,353) of the total mineral interests in Live Oak County. Royalty interests, defined as the mineral value extracted that is paid directly to the lessor usually free of production or refinement costs symbolize 26.94% ($367,062,225). Overriding royalty interests, 3.28% ($44,654,248), are those companies that assist in the drilling of the well in service of the working interests. Finally, 0.06% ($811,369) are payment interests, which act as loans that are repaid through production from the working interest to a firm or individual. In sum, $1.362 billion in mineral wealth are held by 11,348 mineral accounts, which are linked to 758 leases, the majority of which are in the northern part of the county. The average royalty percentage is 20.83%, while the average working interest is 79.54% (Table 6).

In each interest category, the mean is considerably higher than the median and the standard deviation is larger than the mean, indicating that that the vast majority of mineral interest holders have relatively small appraised properties (Table 7). Several entities have much larger interests than the mean, skewing the data as demonstrated by the Gini coefficients. Especially for the working interest, the Gini coefficient reveals that there is close to perfect inequality, while payment, royalty, and override interests also have high levels of inequality amongst all mineral owners.

Table 6: Interest types relative to the number of that type, their average percentages in a mineral leases (if present in that lease), the total amount of that type of interest, and a types' interest relative to all the other interests

Interest Type	Number of Interests	Average Percentage[3]	Total Amount ($)	Percentage of Total Interests (%)
Override Interest	1,702	5.31%	$44,654,248	3.28%
Payment Interest	13	3.92%	$811,369	0.06%
Royalty Interest	8,841	20.83%	$367,062,255	26.94%
Working Interest	792	79.54%	$950,103,353	69.73%

Table 7: Interest types relative to their means, medians, standard deviations and Gini coefficients.

Interest Type	Mean	Median	Range	Standard Deviation	Gini Coefficient
Override Interest	$26,236	$4,523	$505-$1,852,368	$79,684	0.60
Payment Interest	$62,413	$47,480	$843-$279,006	$75,581	0.58
Royalty Interest	$41,518	$5,712	$500-$14,589,218	$226,186	0.58
Working Interest	$1,199,625	$135,235	$575-$50,139,964	$3,213,708	0.94

The five working interest companies with the most lease wealth collectively hold 64.4% of the total mineral capital in Live Oak County. This expressed numerically by a Gini coefficient of 0.94, indicating a high concentration of wealth relative to a Live Oak County Gini coefficient of 0.42 (Batt 2014). Three of the five companies have their tax address in Houston and none demonstrates a tax address in the county (Table 8). In fact,

[3] Values do not add to 100%, because not every lease has all four forms of interest.

of all the working interest, only $299,000 are linked to a tax address in the county, mostly going to a small oil and gas exploration company located in Three Rivers. The other 99.97% is held by firms located outside Live Oak and outside the Eagle Ford Shale (Table 9). This is demonstrated in Figure 13, in which working interests are spatially concentrated in Houston, San Antonio, Dallas-Fort Worth, and Corpus Christi addresses.

Table 8: Top five working interests.

Entity	Total Working Interest Value	Percentage of Total Working Interests	Percentage of All Minerals	Tax City
Burlington Resources and Natural Gas[1]	$411,100,230	43.26%	30.16%	Houston, Texas
Pioneer Natural Resources[2]	$338,020,674	35.57%	24.80%	Midland, Texas
BHP Billiton[3]	$60,832,360	6.40%	4.46%	Houston, Texas
Marathon Oil	$56,970,523	5.99%	4.18%	San Antonio, Texas
Newfield Exploration Company	$10,655,995	1.12%	0.78%	Houston, Texas

Notes to Table 8:
1: Burlington Resources is a subsidiary of ConocoPhillips based in Houston, Texas.
2: Pioneer Natural Resources is based in Irving, Texas, however the tax address is in Midland.
3: BHP Billiton is globally based in Melbourne, Australia, however the tax address for LOCAD data is in Houston.

Table 9: Destinations of Live Oak mineral interest wealth.

Remaining in Live Oak County	**Amount**	**Percentage of All Minerals**
Override Interest	$379,856	0.03%
Payment Interest	$53,869	0.00%
Royalty Interest	$25,882,225	1.90%
Working Interest	$299,000	0.02%
TOTAL	$26,614,950	1.95%
Remaining in Eagle Ford Shale	**Amount**	**Percentage of All Minerals**
Override Interest	$13,128	0.00%
Payment Interest	$471,343	0.03%
Royalty Interest	$45,525,713	3.34%
Working Interest	$16,913	0.00%
TOTAL	$46,027,097	3.38%
Remaining in Texas	**Amount**	**Percentage of All Minerals**
Override Interest	$40,416,248	2.97%
Payment Interest	$810,526	0.06%
Royalty Interest	$321,242,816	23.58%
Working Interest	$941,275,229	69.08%
TOTAL	$1,303,744,819	95.68%

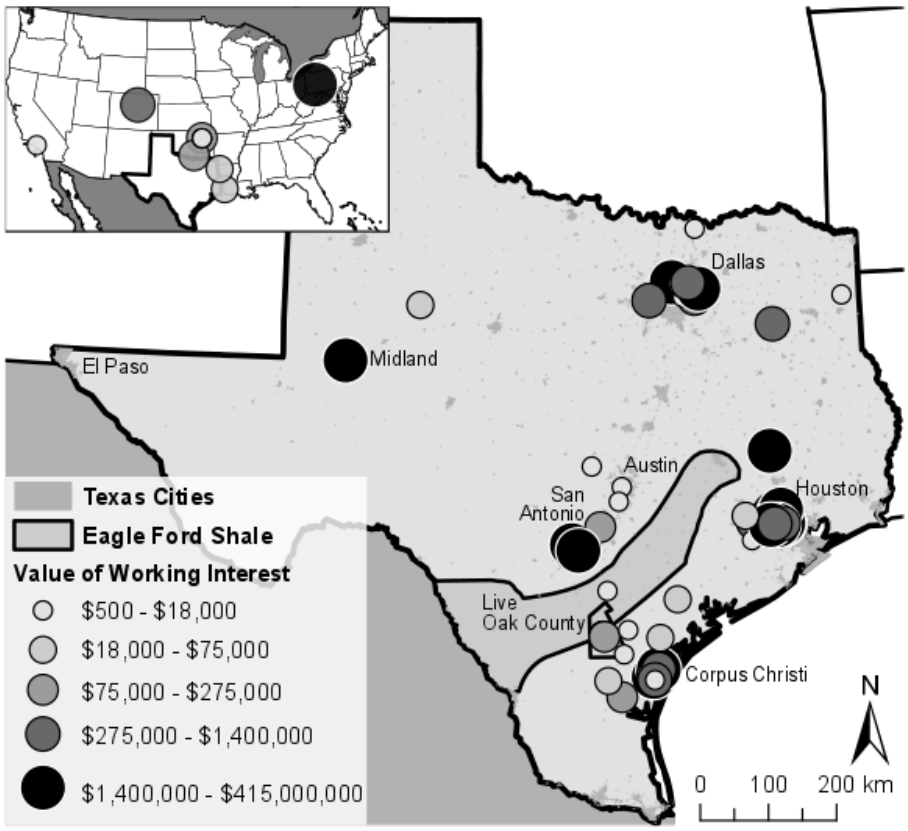

Figure 13: Spatial distribution of the 2015 total working interest in Live Oak County across Texas and the continental U.S.

The top five royalty interest receiving entities collectively hold 5.6% of the total mineral wealth in Live Oak County, but all their tax addresses are outside the county (Table 10). In fact, of all the royalty interests, only 7.05% ($25,882,225) have tax addresses in the county. One of the major recipients of royalties, Mobil Production Properties, is a subsidiary of ExxonMobil, indicating that a large multinational owns a sizable portion (2.07%) of the producing mineral estate in Live Oak County. As further evidenced by the nature of royalty interest ownership, 12.48% (nearly $46,000,000) of

the value is held by entities outside of the state. Royalties are spatially concentrated in in the major metropolitan regions in Texas and across the U.S. (Figure 14).

Table 10: Top five royalty interests.

Entity	Total Royalty Interest Value	Percentage of Total Royalty Interests	Percentage of All Minerals	Tax City
Sinor Ranch, Ltd	$24,496,047	6.67%	1.79%	Deer Park, Texas
BBB Oil and Gas, Ltd	$20,708,085	5.64%	1.51%	Kerrville, Texas
Plomero Ranches, Ltd	$13,052,593	3.55%	0.95%	Fair Oaks Ranch, Texas
1893 Oil and Gas, Ltd	$11,138,642	3.03%	0.81%	San Antonio, Texas
Mobil Production Texas & New Mexico, Inc[1]	$7,621,343	2.07%	0.56%	Dallas, Texas

Notes to Table 10:
1: Mobil Production is a subsidiary of ExxonMobil based in Irving, Texas—a Dallas suburb.

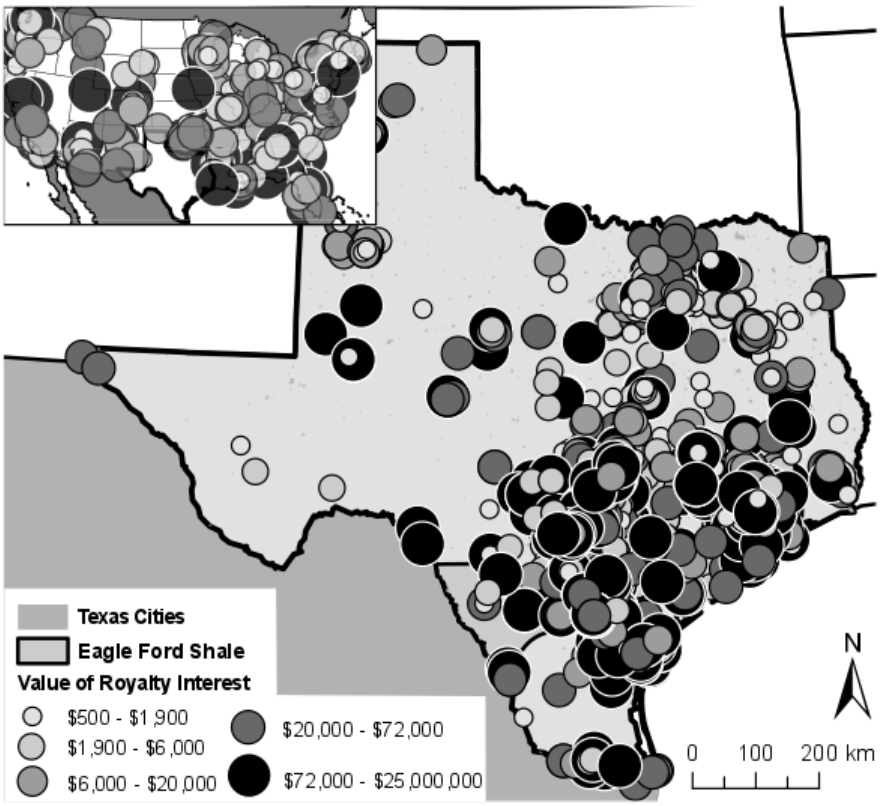

Figure 14: The 2015 total royalty interest spatial distribution across Texas and the continental U.S.

Of the total override interests, 75.3% of the mineral interests are concentrated amongst the top five companies and account for 2.5% of total mineral wealth (Table 11). Three of the largest five have tax addresses in Houston, and none has an address in Live Oak County. Additionally, the largest override interest holder, Amber Harvest Corporation, is a subsidiary of Texas Crude Energy of Houston, Texas. In fact, only 0.85% ($379,856) of all override interests remain within the county with an equally small amount staying local to the Eagle Ford Shale. Overriding interest shares are

distributed mostly in Houston, San Antonio, and the Dallas-Fort Worth Metroplex (Figure 16)

Table 11: Top five override interests.

Entity	Total Override Interest Value	Percentage of Total Override Interests	Percentage of All Minerals	Tax City
Amber Harvest Corporation[1]	$24,793,897	55.52%	1.81%	Fort Worth, Texas
Eagle Ford Austin Interests, LP	$5,152,439	11.53%	0.37%	Houston, Texas
Nine Canyon Interests, LP	$1,853,565	4.15%	0.13%	Houston, Texas
Carlson Oil and Gas, Inc	$935,931	2.09%	0.068%	Edmond, Oklahoma
Weathers, Adriana	$920,463	2.06%	0.067%	Houston, Texas

Note to Table 11:
1: Amber Harvest Corporation is a subsidiary of Texas Crude Energy based in Houston, Texas

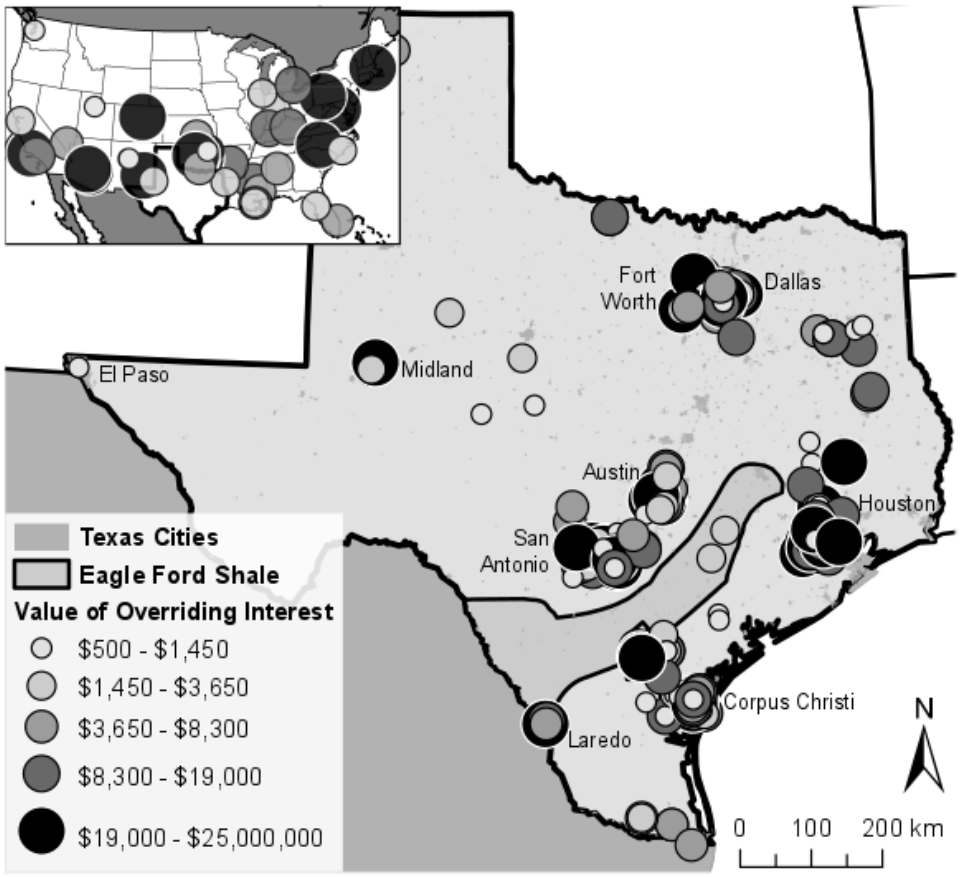

Figure 15: The 2015 total overriding interest spatial distribution across Texas and the continental U.S.

Payment interests account for the smallest amount of mineral interest, but they also have marked differences. About 88% of the payment mineral interest wealth is concentrated in the top five out of 13 mineral holders (Table 12). Of those mineral holders, one has a tax address in Three Rivers, while four out of the five have tax addresses on the Eagle Ford Shale. In fact, 58% ($471,343) of the payment interest mineral wealth has an Eagle Ford address. Furthermore, most payment mineral wealth that is not on the Eagle Ford is concentrated in nearby areas (e.g., San Antonio, Corpus Christi) (Figure 17). Amongst the various forms of mineral interests, payment interests

are, overwhelmingly, the most "local." However the relatively modest total value, 0.06% ($811,369) of the $1.4 billion total mineral value, diminishes the potential economic benefits.

Table 12: Top five payment interests.

Entity	Total Payment Interest Value	Percentage of Total Payment Interests	Percentage All Minerals	Tax City
Ruhmann, James Russell	$327,925	40.41%	0.024%	Cotulla, Texas
Baker Family Trust	$143,418	17.67%	0.0105%	Kenedy, Texas
JLJ Ranch, Ltd	$141,668	17.46%	0.0103%	San Antonio, Texas
Dobie Ranch	$53,026	6.53%	0.0038%	Three Rivers, Texas
Legato Mineral Properties, Ltd	$46,040	5.67%	0.0033%	Universal City, Texas

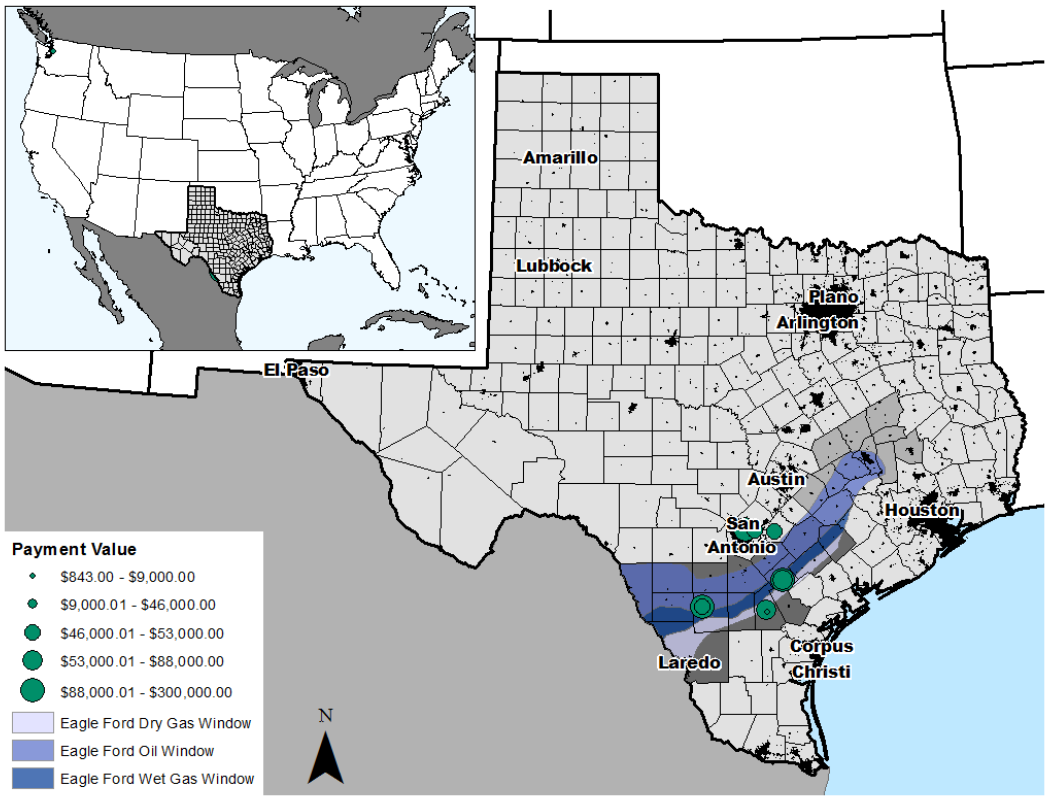

Figure 16: The 2015 total payment interest spatial distribution across Texas and the continental U.S.

5.4 Concentrations in Wealth and Space

Live Oak County mineral ownership is highly concentrated in terms of the Gini coefficient and spatial concentration. This is manifest through the top ten destinations for mineral wealth (Table 13). The top five of those cities have a strong historical connection to the oil and gas industry with Houston being a global hub for energy industry knowledge (Bridge and Wood 2005). More than 77% of Live Oak County's mineral wealth is held by entities with addresses in the top five cities, with 40% of the

mineral interests in Live Oak County held by entities in Houston alone.[4] Three Rivers—the only Live Oak County city on the list—is ranked ninth, the tax address of 1% of the total mineral wealth in the county.

This is visible in Figure 18, which shows that mineral wealth is highly concentrated in the major Texas urban cores. Outside of Texas, mineral wealth is concentrated in places where there is significant drilling today: Colorado, home to the Niobrara Shale; Pennsylvania, home to the Marcellus Shale; Oklahoma, home to the Woodford Shale; and Louisiana, the epicenter of offshore U.S. oil and gas exploration and production (Table 14). Mineral wealth in Live Oak County is spatially concentrated in the two main municipalities—Three Rivers and George West—as well as several unincorporated villages, such as Pernitas Point is the southeastern part of the county and Whitsett to the northwest (Figure 18).

Table 13: Top ten tax addresses of firms holding mineral wealth of Live Oak County.

Ranking	Tax Address City	Amount	Percentage of All Minerals
1	Houston, Texas	$546,333,480	40.09%
2	Midland, Texas[1]	$340,965,904	25.02%
3	San Antonio, Texas	$104,270,194	7.65%
4	Corpus Christi, Texas	$33,224,676	2.43%
5	Fort Worth, Texas	$27,178,286	1.99%
6	Deer Park, Texas	$24,533,545	1.80%

[4] These values refer to the city being queried only. If surrounding communities were included in the analysis (e.g., adding Deer Park's Live Oak County mineral wealth to the Houston mineral wealth or Fair Oak Ranch's to San Antonio), these values would be substantially higher.

Table 13: Continued

Ranking	Tax Address City	Amount	Percentage of All Minerals
7	Kerrville, Texas	$23,284,499	1.71%
8	Denver, Colorado	$13,803,693	1.01%
9	Three Rivers, Texas	$13,392,302	0.98%
10	Fair Oaks Ranch, Texas	$13,101,687	0.96%
TOTAL		$1,140,088,266	83.64%

Note to Table 13:
1: A substantial portion of the Live Oak mineral wealth ($338,020,674) linked to Midland addresses are attributed to Pioneer Resources, a company that is based in Irving, Texas, yet uses a Midland tax address.

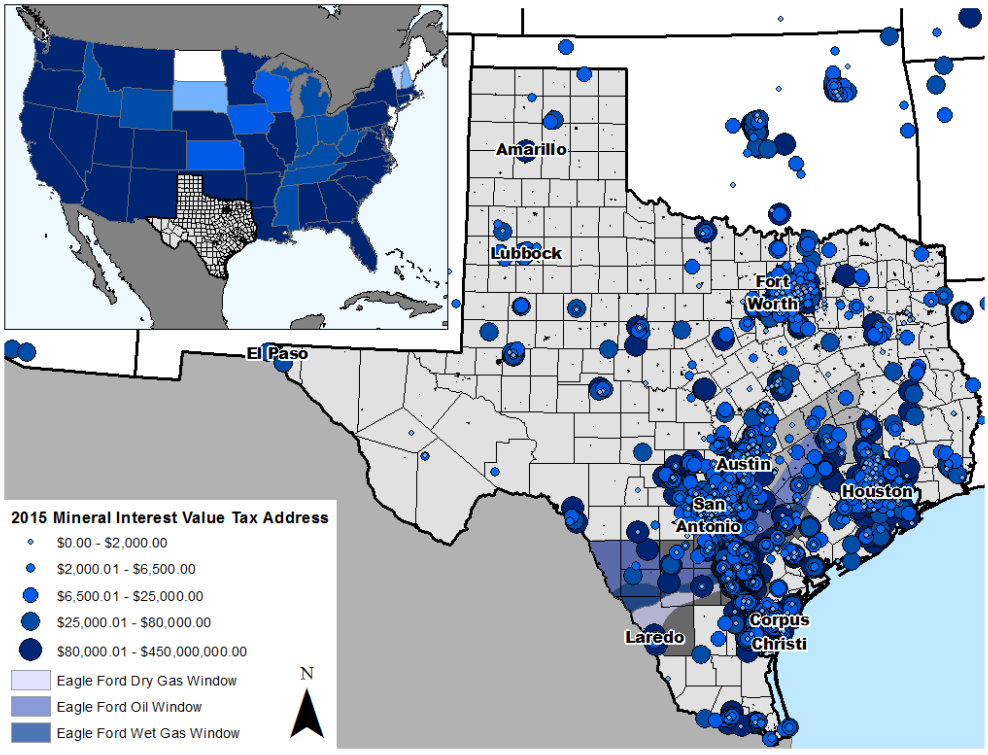

Figure 17: The 2015 total mineral wealth distribution.
As discussed in Section 3, locations with multiple mineral interests have been condensed into one point. Data in the inset map have been aggregated to the state level for legibility purposes.

Table 14: Non-Texas 2015 Live Oak County mineral wealth aggregated at the state level.

Ranking	State	2015 Total Live Oak Mineral Wealth
1	Colorado	$14,468,479
2	Pennsylvania	$7,401,693
3	Oklahoma	$5,553,561
4	Louisiana	$4,340,989
5	Washington	$3,915,409
6	Florida	$3,597,639
7	California	$1,417,990
8	New York	$1,198,280
9	Delaware	$1,049,598
10	Arizona	$502,711

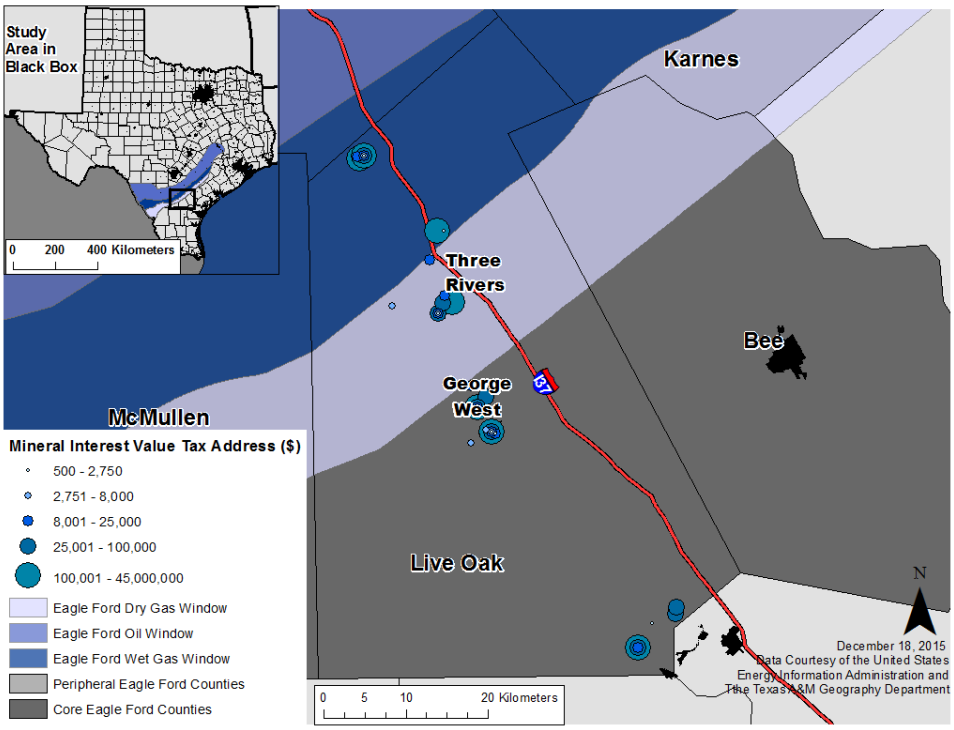

Figure 18: The 2015 total mineral wealth distribution in Live Oak County. Locations with multiple mineral interests have been condensed into one point.

Spatial analysis tools offered in ArcGIS, specifically nearest neighbor analysis and several Moran's I analyses, yielded quantitative indicators of concentration. The results of the Average Nearest Neighbor test yielded an exceptionally low z score of -199.38 and a p value of 0, indicating that the distribution of mineral interest holders is not random. Rather, there is very strong evidence to suggest that mineral holders are concentrated (Figure 19) in certain regions. This data relates to Table 13, which establishes that mineral holders appear to be concentrated in several cities.

Moran's I is used to measure spatial autocorrelation (whether a variable and a location are spatially correlated) and is a preexisting tool in ArcGIS. In this case, I am using Moran's to assess whether mineral wealth is concentrated or dispersed. This test has been applied to three of the four mineral interest types and the total of the mineral interests. The results indicate that overriding royalties are spatially dispersed across the landscape and not due to chance (Table 15). Royalty, on the other hand, is statistically significantly clustered. Working interests are random. Across all forms of mineral ownership, mineral wealth is clustered in certain locations.

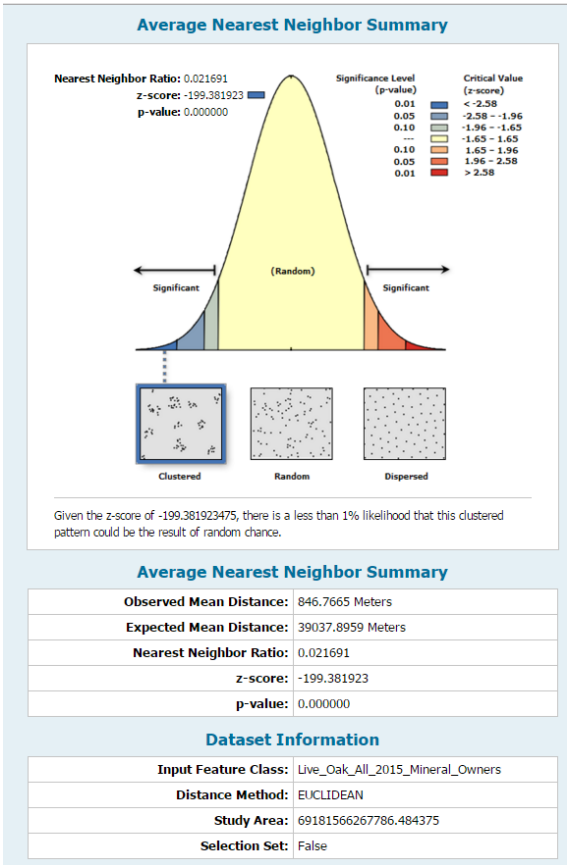

Figure 19: Average Nearest Neighbor summary indicating that mineral owners are spatially clustered.

Table 15: Moran's I values for the mineral interest types.
Payment interest could not be calculated, because there are not enough data points.

Interest Type	Moran's I	z-score	p-value	Autocorrelation
Overriding	-0.0021	-9.0242	0	Dispersed
Royalty	0.0006	4.3546	0	Clustered
Working	-0.0012	0.0111	0.9911	Random
Payment	Insufficient data			
All Mineral Interests	0.0113	68.1437	0	Clustered

5.5 Mineral Wealth over Time

As mentioned previously, I did not aggregate multiple years of assessed minerals, as was done in Fry, Briggle, and Kincaid (2015), because summing then averaging appraisal values would disadvantage newer wells that were drilled during times of lower oil prices. Additionally, the LOCAD dataset lacked the API numbers that would be required to track a producing well across multiple years. However, there are still historical trends in the data that can be used to examine whether mineral wealth has shifted and whether those changes have been spatial.

From a historical perspective, the 2015 total mineral value decreased from previous years (Figure 20). This is not due to decreased production. In fact, Live Oak County oil production peaked in late 2014-early 2015 (Texas Drilling 2015), which should have caused the mineral property value to be substantially higher than the 2014 value. Mineral property values, however, incorporate the price of oil, and between January 1, 2014 and January 1, 2015, the price of oil plummeted by more than 50% from $99 per barrel to $47 per barrel. It should be noted that working interests are the majority of mineral interest totals every year.

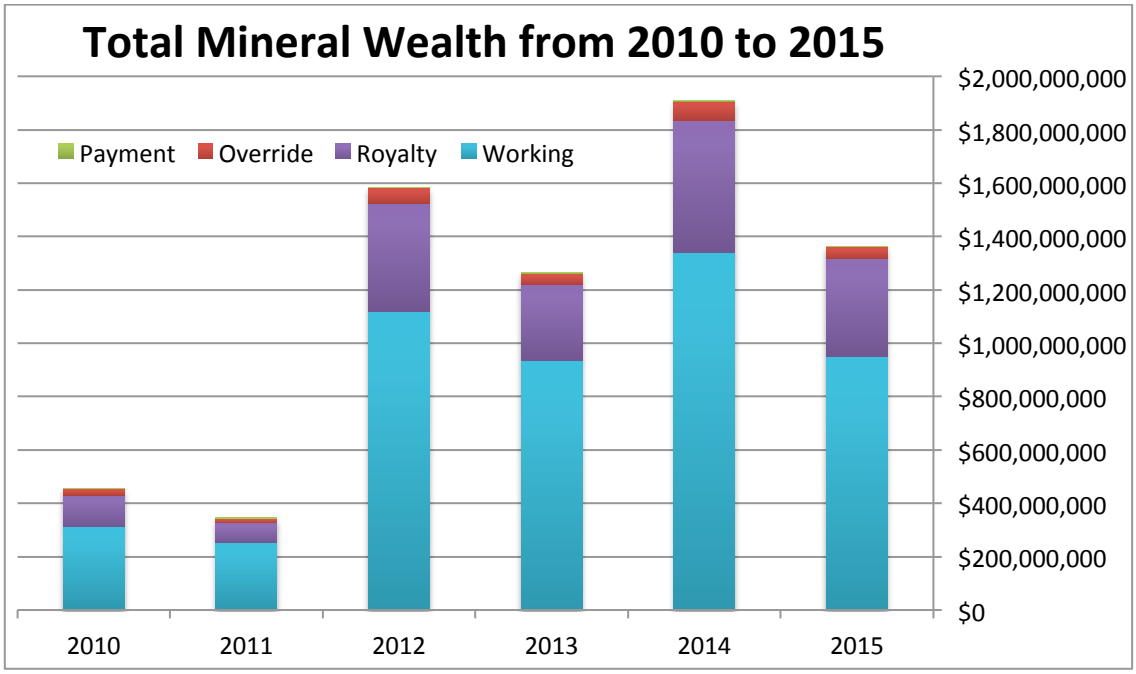

Figure 20: The relative amounts of mineral ownership from 2010 to present.

In addition to the changing mineral interest values, the relative amount of "local" mineral ownership has also been changing. This is demonstrated in Figure 21, in which nearly every form of mineral holdings or ownership has shown a decrease since their relative peaks in 2011. This is most pronounced for royalty interests. In 2011, Live Oak County tax held 2.92% of the total mineral interests in royalties. This has since slipped to 1.9%. Local working interests equally once held 0.79% of total mineral properties, but that has since decreased to 0.02%. The potential significant ramifications of these two findings will be discussed in Section 6.

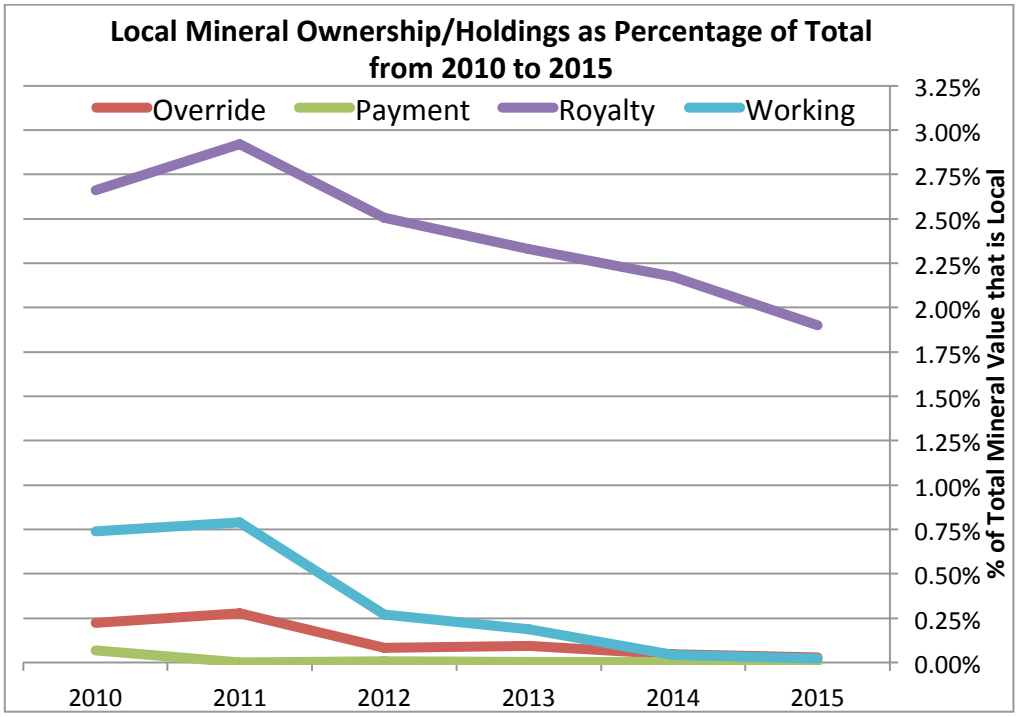

Figure 21: Historical mineral ownership/holdings relative to the total mineral ownership for that year, 2010-2015.
As mentioned previously, "local" is defined as those entities that have a Live Oak County tax address.

5.6 Conclusion

Using Live Oak County appraisal data as a proxy for mineral wealth and methods described by Fry, Briggle, and Kincaid (2015), this section has examined the extent to which mineral interests are both concentrated by owner and spatially concentrated. I accomplish this through an examination of the relative mineral wealth and using spatial statistics. I have also examined the shifts in mineral ownership from 2010 to present.

Live Oak County has over $1.3 billion in appraised mineral properties, but only a small portion (1.95%) is held by individuals or firms with tax addresses in the county.

Moreover, this category has halved since 2011 (3.99%). The largest mineral interest, the working interest, exhibits the greatest amount of wealth concentration with a Gini coefficient of 0.94 and 43% of the total working interest owned by one company. This relatively high Gini coefficient demonstrates that wealth is concentrated amongst a few wealth holders. While less concentrated (as described by the Gini coefficient), royalty interests are still mostly owned by entities with tax addresses outside Live Oak County. Of the top five override interests holders, three have tax addresses in Houston; however according to Moran's I statistic, this interest type is spatially dispersed. Payment interests, the most "local" of all mineral interest types, are relatively insignificant in total value compared to other forms of assessed minerals interests.

Live Oak mineral interests in Texas are spatially clustered in Houston, Midland, San Antonio, and Corpus Christi. Mineral interests outside the state are clustered in Colorado, Pennsylvania, Oklahoma, and Louisiana. All of these cities and states have established histories of oil and gas production. Furthermore, evidence suggests that Live Oak County has been experiencing decreased local mineral ownership and holdings since 2011. The implications of this and the other findings in this section will be discussed in Section 6. It should be noted, however, that this study has not determined the manner by which two firms have accumulated the mineral holdings. Additionally, this thesis has not explored the manner by which surface and subsurface estates were severed. Given that mineral estates are bought and sold in a similar manner to surface estates, it would require substantial effort to determine how this historical process occurred for every mineral property.

6. DISCUSSION

6.1 Introduction

This section integrates the findings from the two results sections (Sections 4 and 5) into a discussion that relates findings to the relevant literatures. Mineral ownership data help provide additional insight into the three main themes that respondents highlighted (roads; housing; wages) relating to oil and gas exploration in south Texas. The high rate of Live Oak County absentee mineral ownership supports what respondents argued about mineral ownership; more broadly, absentee tenure is potentially changing scalar politics and political economy relations between Texas metropolitan regions and Live Oak County. Finally, I attempt to answer the research question: Does a resource curse exist on the Eagle Ford Shale?

6.2 Unequal Wealth Distribution

The Section 5 results indicate that the mineral estate tenure in Live Oak County is produced through absentee ownership. Live Oak data indicate that potentially enormous monetary benefits accrue outside Eagle Ford counties to other regions of Texas and beyond. This finding challenges economic models demonstrating vast amounts of mineral wealth remaining local to extraction sites (Tunstall et al. 2014). Even the royalty wealth, a staple amongst shale energy economic impact analyses, is modest, as only 7% is "local" to the county and 12.4% remaining local to the Eagle Ford Shale region. This result contradicts previous royalty studies of the Eagle Ford that estimated in-county

ownership in Texas at 21.7% and Eagle Ford royalty ownership at 24.5% (Brown, Fitzgerald, and Weber 2015).

The discrepancy has possible explanations. Live Oak County could be unique in that surface properties were frequently sold but mineral properties were withheld from the sale—more so than in other Eagle Ford counties—but I am not aware of different land-sale conditions in Live Oak compared to other counties. Courthouse records used by Brown, Fitzgerald, and Weber (2015) may not have the most updated address information for mineral estate owners. Different mineral estate tenure may exist among *producing* mineral properties as opposed to *all* mineral properties.

The methodological approach taken in this study is supports different results. The approach offers a contrast, primarily in the detail of the mineral holdings, to the claim that royalties are "estimated at 20% of the total revenues from oil and gas operations" (Tunstall et al. 2014, 84) or using the dubious assumption that absentee *surface* ownership as a proxy for absentee *mineral* ownership (Kelsey et al. 2011). The present methodology provides a manner to accurately determine relative mineral ownership holdings and to estimate how ownership may be leveraged into positive economic impact, which is one of the main shortcomings of fracking economic impact studies (Rousu, Ramsaran, and Furlano 2015). As a reminder though, only completely intact local mineral estates have a tangible effect on the local economy (Weber, Brown, and Pender 2013). Additionally, the present methods offer a way to estimate the influence that firms have in a resource extraction milieu and the nature of that extraction—for

example, the working interest holder might have a greater economic impression at the site of extraction than an override interest holder.

The results indicate that Live Oak County mineral interests are locked into a traditional core-periphery relationship in which mineral wealth is concentrated outside the county. In this case, the major Texan metropolitan centers are playing the role of the core, while Live Oak County is the resource periphery. This paradigm provides an example of a process that seems so prevalent in developing countries: hydrocarbons are extracted from the periphery in exchange for increasing wealth and power to established core regions (Peluso and Watts 2001; Watts 2005), a lose-lose situation for local residents who do not own a producing mineral estate. While there may be some direct benefits to Live Oak County in such a system—such as through the mineral interest holders who reside in the county—the majority of the benefits concentrate to the core metropolitan regions, where tax addresses of the majority of mineral interests are located. County residents who are not direct recipients of mineral wealth face the negative environmental externalities associated with shale fracking (Fry, Briggle, and Kincaid 2015), as well as the externalities associated with explosive boomtown development—such as degraded roads, a limited housing supply, and workforce complications (Section 4). Furthermore, the longer such resource extraction ensues, the more likely the region will be reimagined as a resource production region—"ghost acreage" composed of "disembodied nature of commodity spaces as shapeless, people-less forms without histories or geographies" (Catton 1982; Bridge 2001, 2154). However, to state that this wealth distribution is permanent in space and time would be

incorrect. Indeed, oil and gas firms are frequently bought and sold, possibly creating new spatial distribution of mineral wealth.

For example, the first oil and gas firm to frack a well on the Eagle Ford Shale, Petrohawk Energy, had tax address in Houston, Texas. In August 2011, Petrohawk was acquired by BHP Billiton, which owns 4.46% of total Live Oak mineral wealth, and has a U.S. headquarters in Houston (the tax address of their Live Oak County wells) but a global headquarters in Melbourne, Australia. This dynamism creates complex webs of networks that entail prohibitive effort to disentangle as described in Bridge (2008). Furthermore, especially in an active play like the Eagle Ford Shale, mineral interests are frequently bought and sold among the firms that are producing them, as well as amid mineral estate holders. Those interests can grow or shrink in size depending on the circumstances of the transfer. While state law requires that taxes be levied on the correct entity, it is difficult to track how a particular mineral estate changes ownership over time.

Relating to the research question, the concentration in wealth amongst the few resulting in increasing economic inequality is one of the tenants of the resource curse (Sarraf and Jiwanji 2001). With a Gini coefficients over 0.5 for all the mineral interests and working interest with a Gini of over 0.9, wealth appears to be concentrated. These values contrast with the estimated Gini coefficient for the county at 0.42 (Batt 2014). The findings, therefore, indicate that mineral wealth is more concentrated than nominal income wealth at the county level. Furthermore, these concentrations of wealth are distant from Live Oak County and clustered in metropolitan cities across the state. While

I will discuss this in greater detail later in this section, the results indicate that this tenant of the resource curse is potentially present in Live Oak County, and provided wealth conditions are similar across the region—which I have no reason to assume differently—the concentrating wealth is an indicator of the resource curse's present across the Eagle Ford Shale.

6.3 Mineral Wealth in Live Oak County versus Denton, Texas

This section of my thesis discusses the parallels and differences between Denton, Texas, the study site of the only other appraisal district mineral wealth study (Fry, Briggle, and Kincaid 2015), and Live Oak County. While there are many mineral interest holders, the majority handles relative small interests and a small number of interest holders hold the majority of interests. The top five interests in each category collectively hold 72% of the total mineral wealth. Of the top twenty firms and individuals, only one is local to Live Oak County, with 0.0038% of total mineral wealth. Even among royalty interests—the interest that is touted by oil and gas companies to bring wealth to locals—the largest receiver holds 1.79% of total mineral wealth; Sinor Ranch Ltd, which is based in Houston and run by an individual who had familial ties to the area. More significantly, oil and gas firms appear to *own* significant portions of mineral properties as indicated by the presence of a ConocoPhillips subsidiary, Burlington Resources, and Mobil Production, an ExxonMobil subsidiary.

In a stark contrast to the Denton study (Fry, Briggle, and Kincaid 2015), Three Rivers and George West do not own producing mineral properties. Three Rivers

Independent School District (ISD) has several mineral properties collectively valued at $58,310 and George West ISD has a property valued at $519, barely above the minimum required for taxation. The county government does not have active mineral producing properties, but the Texas state government holds $218,451 in appraised mineral estates. It is unknown whether these properties are actually owned by the Texas state government or are county roadway easements whose associated mineral properties will soon be devolved back down to the county (Section 4.3). All of this is to note that there are marked differences between the nature of mineral property ownership in the city of Denton on the Barnett Shale and the dynamics in Live Oak County.

6.4 How Mineral Wealth Became Absentee

While the quantitative evidence suggests that mineral ownership is largely absentee, economic development stakeholders were divided whether mineral ownership is more local or absentee. As discussed in Section 4.6, interview respondents offered diverse opinions on the amount of local mineral ownership, yet the quantitative findings from Section 5 demonstrate that a very small portion of the mineral wealth remains in Live Oak County. This happens in a variety of avenues: selling a division of the mineral estate during the sale of the surface property to attract a buyer, retaining the mineral estate while selling the surface property and it fragmenting through generations of ownership, mineral owners selling part of their estate to property acquisition companies to shore up personal finances.

Another option is that the surface estate owner still holds the mineral rights, but has left the county. Transitional land use patterns in Live Oak County may contribute to the absenteeism of combined surface and mineral property. As mentioned previously, the county transitioned from farming to ranching (Hester 1996) in the mid-20th century. Recently however, the county has transitioned more towards hunting leases as indicated through qualitative evidence from this study:

> "We still have our hunting industry. We lost all our farming. I mean lot of the ranches … a lot of it has gone to hunting…. We're in the Golden Triangle for all the people who want to come white tail deer hunting and started everybody putting up deer-proof fence, started managing their hunts and managing their deer herds. So, until oil came along, that was the only industry" (EFS003).

Studies have indicated that potentially more money can be gained through the creation of hunting leases than through cattle ranching (Livengood 1983; Pope 1985). According to a 2006 economic study, hunters paid approximately $301,000,000 for hunting leases across the state (Southwick and Southwick 2007). These hunting leases can be managed from afar and do not require the landowner to remain local to the region. As a result, the landowner has the option to move away from the county. In many circumstances hunting and ranching land uses are not necessarily in conflict with one another, and the landowner can continue to ranch the property using local land managers who also oversee hunting leases. This study did not examine whether surface property owners are also absentee or the level to which surface ownership correlates to mineral ownership.

Additionally, this study did not examine how firms acquired mineral wealth. As mentioned previously, the oil and gas industry milieu is dynamic as firms are frequently bought and sold (Bridge 2008), leading to new concentrations of mineral wealth. It is close to impossible to examine how these concentrations have changed for every mineral owner in Live Oak County. Furthermore, it is unknown how energy firms came to *own* oil and gas wealth. Mineral owners may sell their minerals during times of financial hardship or to provide a boost to their personal finances; how this money is spent is up to the previous mineral owner and could lead to even greater wealth than if he or she had held onto the mineral rights. That stated, it is uncertain whether these were the motivating reasons for company *ownership* of mineral wealth.

6.5 An Eagle Ford Royalty Paradox

Why are economic development officials still supportive of oil and gas development if they 1) have to manage overused infrastructure with insufficient budgets; 2) consider the construction of short-term housing that may not translate to long term residents; 3) supervise governance structures that are unable to retain workers due to inflated wages; and 4) oversee a boom in which mineral wealth is largely absentee?

I hypothesize three responses to this question. While the majority of economic development officials were aware that there was a combination of local and absentee mineral ownership, they may overestimate the amount of local ownership. This could lead them to have a positive view of mineral ownership in their municipalities and counties despite the actual local ownership amount being much lower.

The second possibility is that respondents are aware of the true amount of mineral ownership yet still support energy development. As demonstrated in Brannstrom et al. (2015), a royalty paradox exists in those situations in which "a tiny fraction of the overall rural population receives royalties" (1183) yet the energy development is embraced. Local economic officials were proponents of oil and gas development; nevertheless many were equally aware that mineral ownership in their jurisdictions was immensely complex. This is likely because stakeholders perceive of the economic benefits beyond direct access to shale, in the form of increased tax revenues, increased hotel occupancy, increased use of local businesses by DIDO oil and gas workers, and occasional corporate volunteerism. Additionally, the pro-oil and gas ethos of the state (Rahm 2011) likely contributes to positive economic feelings towards upstream petroleum development. Finally, there are other ways surface owners may receive benefits from mineral extraction even if they do not own the mineral rights. While oil and gas companies are not required to do so, they can pay surface owners for damages to property (Railroad Commission 2015b). Furthermore, respondents across the shale play mentioned how exploration companies would use excess materials from the drill site to install new pasture roads and fences as a form of goodwill.

The third possibility is that despite local ownership being a relative small amount of the overall total wealth, the amount that is flowing to communities is important given the historic context. Leading into the boom, south Texas was one of the poorest regions of Texas (Tunstall 2015a). Resource extraction, therefore, has brought money into a region starved of capital for decades. This is reflected in popular media accounts that

support increasing cash deposits relative to loans at Eagle Ford banks (Malewitz 2014a). However, a *Houston Chronicle* article noted that one Eagle Ford bank had increasing loans relative to the number of deposits: South Trust Bank in the Live Oak County city of George West. This one bank accounted for 35% of the total amount of loans made on the Eagle Ford Shale (Danner 2015). According to the newspaper article, the CEO attributed the high number of loans to a new Houston branch and not necessarily to Live Oak County specific circumstances. In summary, while the amount of direct mineral wealth being generated for locals from Live Oak County is small, the small amount might be having a larger impact, because the region was capital scarce.

6.6 The Migration of Political Power

Resource benefits located outside Live Oak County create dynamic and complicated political relations that, as of 2014 and 2015, have potentially morphed the Texas political landscape. Traditionally, municipal governments had been given considerable liberty to operate free from state oversight provided that regulations were couched in benefits for the general health and welfare of the public (Riley 2007; Fry 2013). City officials have used this authority to create and implement regulations that manage oil and gas drilling in their towns. This was most apparent when Denton—a municipality particularly affected by the negative externalities of urban gas drilling—banned fracking by popular vote within the city limits in November 2014. (Refer to Section 4.2.3 for economic development officials' responses to Denton.) In a reaction to Denton, legislation passed at the state level in May 2015, House Bill (HB) 40, prohibits (i.e., preempts) municipal

governments from implementing drilling regulations that are not "commercially reasonable" (Darby et al. 2015; Maqbool 2015), thus eliminating a potential regulatory tool Eagle Ford economic development officials could use to slow development in the region. This bill was strongly supported by the Texas Oil and Gas Association (TXOGA), the Texas Alliance of Energy Producers, Texas Independent Producers and Royalty Owners Association, and the Texas Land and Mineral Owners Association (TLMA), and many other pro-hydrocarbon related organizations (Texas Legislature Online 2015). These bodies opposed the developing "patchwork of inconsistent regulations that undermines safe and efficient production of oil and natural gas" (TXOGA 2015). The argument that a "patchwork effect of local ordinances [creates] inconsistent regulations" for the oil and gas industry (Way 2015) was a major theme supporting HB 40.

Davis and Hoffer (2012) make a strong case for why oil and gas companies and mineral interests prefer to have regulations at the state level; however, they do not explain why energy firms object to municipal or county regulations. Undoubtedly, the consistency of laws was an important driver for the changing scales of hydrocarbon governance for firms, but why would mineral owners so negatively react to the Denton ban? The reality is that Texas has always had this municipal patchwork of laws due to the large amount of regulatory power given to city governments. Rather, I propose that the changing nature of mineral ownership is a more significant, yet neglected, impetus.

Economic development officials discussed this point in interviews: local landowners, at some point in the past, owned much more of the mineral estate than they

do today. When asked whether local property owners retained their mineral rights when they sold the surface estate, one interviewee responded, “They do now….There’s a lot of land that’s been bought and sold without the minerals in the past 20, 30 years” (EFS014). This is corroborated by the changing history of mineral ownership in Live Oak County with mineral royalties increasingly going to absentee owners (Section 5.5). However, this trend is not only with royalties; local working and overriding interest holders had decreasing ownership between 2011 and 2015 compared to absentee entities. While unlikely cause of this process is unknown, the ramifications are apparent. As absentee mineral ownership and holdings increase, there are fewer mineral owners who are able to participate in local elections. This is because residents are only able to vote in those elections that are pertinent to their residence (Texas Constitution and Statutes 1986). As a result, absentee mineral owners no longer have the ability to represent themselves at the local level of their mineral estate. This may help explain why mineral owners are adamant about changing the scale of regulation from municipal to state level. Consequently, local government drilling regulatory powers are being preempted by the state legislature and advanced into a different political sphere—a sphere that engages in active neoliberal, “race to the bottom” competition in terms of hydrocarbon regulations (Rabe and Mundo 2007, 269; Davis 2012). This relocation of power could disrupt local political networks that, at one time, had stronger dependence on local representation. As the mineral estate dynamics change, the nature of the hydrocarbon politics will react, causing shifting social relations at the local level.

6.7 Gilmore's Assumption and the Industry-Civic Relationship

Gilmore believed that the approaches energy firms were using to offset the negative boomtown-related development were blurring the lines between the public and private sector, as industry officials worked with civic organizations, municipalities, and counties by volunteering time and money (Schmidt 1981). But how well does the Gilmore model predict industry involvement today? A few Eagle Ford Shale economic development officials lamented that oil and gas companies did very little to help their jurisdictions: "In the first boom [in the 1970s-80s]…the companies took more interest in the community. [They] sponsored stuff, but now they don't have much interest" (EFS011). The feeling that oil and gas companies seemed to shirk civic involvement was much more prevalent on the periphery of the play than in the core. However, even in the core, there was at least one respondent who questioned some of the motivations by oil and gas companies: "These operators of big cities… think they're going to come down here and pull the wool over these people [(locals residents)]… It's been a hard scrabble for years and years, trying to make ends meet. Before this [oil and gas boom] happened, we were one of the 20 poorest counties in the whole U.S." (EFS003).

This respondent demonstrated what the quantitative aspect of my research shows: that mineral operators are coming from afar and may potentially not know the local circumstances. He makes a strong distinction between the townspeople and them ("these operators of big cities"). In doing so, he speaks to a literature that is aware of the ability of outside firms to disrupt lifestyles (Willow and Wylie 2014). This is not to state that all firms diminish economic development outcomes by not participating in civic

volunteerism. Local firms, or even non-local companies that were strongly embedded into the municipality, were cited as harbingers of good business practices: "the partnerships or the good relationships that we have are the oil field companies that have been here for a long time" (EFS010).

Given that the quantitative Live Oak County evidence suggests that local firms are participating less in Live Oak County drilling activities relative to non-local firms, it can only be assumed that there will be decreasing corporate involvement in civic, non-regulatory affairs. Gilmore noted that there was a need "for industry-wide…willingness to cooperate as the states create new institutions, taxes, and implementation programs for dealing with the problems created by western energy resource development" (Gilmore 1976, 540). It is unknown whether oil and gas companies would accept such an imposition today any more than they would have in the 1970s.

6.8 Answering the Research Question: The South Texas Resource Curse

Does a resource curse exist on the Eagle Ford Shale? Social scientists have proposed many, often disparate, mechanisms through which resource abundance distorts the development process (Frankel 2010; Torres, Afonso, and Soares 2013), however this thesis summarizes its mechanisms as: 1) the emergence of the Dutch Disease, whereby resource sector exports increase a country's monetary value, which crowds out investment and entrepreneurship in less competitive infant industries (Neary and Van Wijnbergen 1986; Auty 2001; Gylfason 2001; Rodrik, Subramanian, and Trebbi 2004; Michaels 2011); 2) resource extraction degrades the physical environment deterring

potential post-extraction economic growth (Gylfason 2001; Sachs and Warner 2001; Michaels 2011); 3) competition for resource windfalls promotes rent-seeking and corruption, distorting the formation of social capital institutions (Ross 1999; Auty 2001; Torvik 2002; Isham et al. 2005; Humphreys, Sachs, and Stiglitz 2007; Kolstad and Wiig 2009; Michaels 2011); 4) this rent seeking behavior causes decreasing per capita incomes (Torvik 2002); 5) worsening economic inequality (Sarraf and Jiwanji 2001); and 6) the influx of investment into a region causes a disruption to the local societal fabric (Gilmore 1976; Haslam Mckenzie 2013). Typically, the resource curse is applied to entire countries; however, it is not uncommon for investigators to apply it to sub-national regions (Haggerty et al. 2014; Weber 2014; Tunstall 2015b). The evidence presented in this thesis indicates parallels between the economic development outcomes in south Texas and the negative ramifications of the resource curse. While my thesis directly assess the resource curse' latter two characteristics—worsening economic inequality and social disruption—I will use the remainder of this section to situate my findings in relation to all the resource curse mechanisms.

6.8.1 Dutch Disease

Traditionally, the Dutch Disease represented how increased resource extraction and export leads to appreciating exchange rates of the host country. This causes manufactured goods destined for export to be more expensive outside the country, inherently leading to resource extraction displacing manufacturing (Neary and Van Wijnbergen 1986; Larsen 2006). However, recent explanations of the Dutch Disease

frame it simply as "the level of oil's share of economic activity" (Larsen 2006, 618) relative to the other sectors. If oil's share is increasing at the expense of other sectors, then the Dutch Disease is present. Since south Texas does not have its own currency market, this subsection will examine the Dutch Disease via the second Larsen (2006) definition.

While there is limited quantitative evidence to suggest that mineral extraction is supplanting local businesses, local economic development officials noted how it had become increasingly difficult for their organizations to hire and retain the necessary workforce. This problem, at least according to some, had extended into the service industry, where local eateries, gas stations, and even truck dealerships were unable to retain workers because the oil and gas industry offered higher wages. It is unknown whether the downturn in oil prices and drilling activity since 2014 will influence the local labor and industry regimes. While oil and gas *can* have a positive influence on establishing linkages to the local economy (Bebbington 2012, 17), that does not appear to be taking place with regard to Live Oak County. The best quantitative evidence is that *local* working and overriding interests, the two interest types that would most likely be associated with firm embeddedness and linkages, only account for 0.05% of the total 2015 mineral wealth. More concerning is the fact that two firms, Burlington Resources and Pioneer Natural Resources, hold ~55% of the total mineral wealth in Live Oak County.

Additionally, local working and overriding interests have been contributing less to total mineral wealth since 2011. As described by the literature, a firm's linkage to the

local economy, which may ameliorate some of the negative ramifications of resource extraction, can take decades to establish (Cumbers 1995; Freudenburg and Gramling 1998), and so far there is little evidence of that taking place in Live Oak County through quantitative data or regionally through qualitative data. Even if these linkages do develop, specialization in the oil and gas sector, at least as described in the U.S. Mountain West, leads to decreased economic performance in the long term compared to other economic endeavors (Haggerty et al. 2014). Finally, Tunstall (2015a) hinted that the Dutch Disease may be present on the Eagle Ford, but he offered no evidence to support this claim.

6.8.2 Environmental Degradation

Economic development officials rarely mentioned environmental degradation, and when they did, it was relevant to the amount of water required to frack a well, as well as the possible contamination that broken well casings can have on underground aquifers. This is an important concern to economic development officials, especially those on the western part of the play where there is less precipitation. As one respondent stated:

> "We don't know the contamination effects, where the industry obviously says one thing and the environmentalist obviously says another. We're using a lot of water, and at some point, you're going to pay the piper. We're in the middle of a drought right now. Our lake is 30% below [normal levels]. You can't drink oil. Water is a big issue." (EFS002).

From an economic development perspective, water holds importance to that particular municipality because of the fishing tourism of the nearby lake. Besides water,

research suggests that air pollution from the flaring of excess natural gas on the Eagle Ford Shale could be having negative impacts on the local and regional air quality (Schade and Roest 2015), however locals were more skeptical: "And they came out about [it in the] *San Antonio Express* saying that 'Eagle Ford Responsible for San Antonio's Non-Attainment of Air Quality.' And I was at the conference and I said: 'You know this is B.S.!'" (EFS007). It should be reiterated that changes in environmental quality are having an *unknown* impact on Eagle Ford economic development.

6.8.3 Rent Seeking Behavior

My research did not examine whether the boom on the Eagle Ford Shale is leading to increasing rent seeking behavior, nor am I aware of any research or popular media accounts that have indicated rent seeking is taking place on the Eagle Ford.

6.8.4 Decreasing per Capita Incomes

One prior investigation of the Eagle Ford suggests that the resource curse is *not* taking place. As discussed in Tunstall (2015b), "completed wells have a direct, positive impact on per-capita income" (88) between 2008 and 2011. Tunstall, therefore, rejects the resource curse for the core of the Eagle Ford Shale. While his methodology is sound, the evidence presented here indicates that the resource curse rejection may have been premature. In the years succeeding the timeframe of Tunstall's study, petroleum prices increased, leading to enhanced drilling across the region until 2014. After a peak in June 2014, oil prices have since fallen to decadal lows. This has resulted in significant

regional economic retrenchment and decreased drilling. It is not known whether this slowdown in activity has corresponded to a decrease in per capita wealth. Additionally, Tunstall has limited his definition of the resource curse to one mechanism, decreases in per capita incomes, while the resource curse actually includes many of mechanisms.

6.8.5 Worsening Economic Inequality

The results from Section 5 imply that mineral wealth is concentrating outside of Live Oak County potentially leading to worsening economic inequality. This was determined through public tax records as a *proxy* for total mineral wealth. Of all mineral interests, only 1.95% is staying local to Live Oak County and 3.38% is staying local to the Eagle Ford Shale. The high Gini coefficients—0.6 for override interest, 0.58 for payment interest, 0.58 for royalty interest, and 0.94 for working interest—indicate that wealth is concentrated with relatively few owners and holders. Furthermore, this wealth is spatially concentrated to the metropolitan regions of Texas as determined through tax addresses, with addresses in Houston, Midland, San Antonio, and Corpus Christi collectively owning or holding ~78%. All of these cities have strong historic ties to the oil and gas industry.

Furthermore, the amount of local relative mineral wealth in Live Oak County has been decreasing since 2011. In 2011, 3.99% of the total mineral interest was held and owned by in-county entities. By 2015, this amount had slipped to 1.95%, demonstrating that mineral wealth from the county is being accumulated outside of the county.

Therefore, as demonstrated through LOCAD data, mineral wealth is concentrated outside the county; the amount of absentee mineral ownership and holdings has been increasing relative to the county's increasing mineral wealth. This research, therefore, proposes that worsening economic inequality in terms of mineral wealth is present on the Eagle Ford Shale.

6.8.6 Social Disruption

The updated Gilmore (1976) problem triangle (Section 4.7) implies that social disruption is taking place. As municipal and county officials grapple with overused infrastructure, a mismatch in desired housing construction and what is actually built, and high wages leading to ineffective governance, the problem triangle demonstrates that as long as resource extraction takes place, residents will have to contend with a decreased quality of life.

Increased absentee ownership of mineral wealth also contributes to a change in political relations because owners of minerals may seek to interact more with state government than municipal government, which is compounded by the passage of HB40 (Section 6.5). Furthermore, the arrival of DIDO oil and gas workers may also affect interpersonal relationships, as one respondent indicated: "I swear, you would walk into a restaurant and know everybody. And now you walk and you don't know anybody!" (EFS005). This degraded sentiment of community may be heightened in locations where residents receive few direct benefits, such as the case of Live Oak County or where environmental injustices arise due to the siting of disposal wells in neighborhoods of

color (Johnston, Werder, and Sebastian 2016). Furthermore, weak regulation at the state level (Davis 2012) and decreasing regulatory authority at the municipal level lead to decreasing institutional power to regulate oil and gas drilling and increasing partiality towards the oil and gas industry, approaches that exacerbate the resource curse (Kolstad and Wiig 2009).

In these circumstances, communities on the Eagle Ford Shale appear to suffer from the ramifications of social disruption. The presence of this mechanism indicates that the Eagle Ford is *probably* experiencing the resource curse through social disruption.

6.8.7 Resource Curse Presence?

To summarize, is the resource curse present on the Eagle Ford Shale? Two mechanisms, concentration of capital in the form of mineral wealth and social disruption, appear to be present. While qualitative—and to some extent, the quantitative—data indicate that the Dutch Disease *could* be present, future researchers would have to assess south Texas economic sectorial changes. The interview respondents rarely mentioned environmental damage as a ramification of growth; however, a recent air quality study demonstrated that poor air quality over the shale could be contributing to poor air quality in San Antonio (Schade and Roest 2015). Other studies should be conducted to determine whether environmental degradation extends beyond air quality and whether that environmental damage is having an economic ramification. There is no research to suggest that rent-seeking behavior is (or is not) present on the Eagle Ford Shale. Finally,

Tunstall (2015b) examined whether the resource curse was present via decreasing per capita income. His study conducted from 2008-2011 demonstrated that particular mechanism is not present. Oil prices have since fallen to decadal lows. This resulted in regional economic retrenchment and decreased drilling. It is not known whether this slow in activity has corresponded to a decrease in per capita wealth. Given these circumstances, it is unlikely that municipal and county economic development officials will have the power to regulate Eagle Ford development adding further evidence of a potential resource curse for the region. As one respondent put it so poignantly: "[Oil and gas development] depends on the price of oil!" (EFS004) and not the actions of local policymakers.

6.9 Conclusion

This section has merged the results from the semi-structured interviews discussed in Section 4 and the Live Oak County mineral interests data discussed in Section 5. I have discussed the power of mineral assessment data, the winners in mineral extraction described in through a traditional core-periphery model, whether mineral ownership conforms to econometric perspectives of the nature of mineral holdings, how mineral holding patterns could be causing changes in the state's political economy, and whether the Eagle Ford Shale is experiencing a resource curse.

Some political and economic processes in the Eagle Ford Shale deserve greater attention, such as the extent to which the resource curse is taking place or the linkage between shifts in scalar politics and corresponding scalar changes in mineral ownership.

I question the veracity of previous economic impact studies that assume all mineral wealth is "local" to the county, region, or even to the state. I also note that Live Oak County appears to be locked into a traditional core-periphery relationship in which direct benefits of hydrocarbons are located outside the Eagle Ford Shale, in Texas metropolitan regions. Furthermore, the most significant winners in energy extraction in Live Oak County appear to be a small subset of companies that have large mineral holdings (and, in some cases, actual ownership of estates). Economic development stakeholders appear to be aware of this, and yet still largely support oil and gas extraction in their municipalities through the royalty paradox. Low local mineral ownership may lead to substantive political changes in the form of shifts in scalar politics and in social relations between energy firms and municipalities, locals, and each other. I challenge assertions that south Texas has avoided resource curse ramifications by demonstrating that there has been worsening economic inequality, as determined through mineral wealth studies, and a social disruption, spurred by boomtown conditions.

7. CONCLUSION

7.1 Thesis Summary

This thesis asked one question: Does a resource curse exist on the Eagle Ford Shale? While it is difficult to unequivocally confirm the resource curse on the Eagle Ford, there are indications that it is present. This answer is derived from the results of my two objectives: 1) determining the normative economic development narratives to energy development present on the Eagle Ford Shale in comparison to the foundational piece on boomtown development, Gilmore (1976); and 2) determining the relative spatial distribution of mineral wealth in Live Oak County.

To accomplish those two objectives, first I had to examine those investigations of energy geographies that have already been accomplished. I traced how social scientists analyze regional development in a resource extraction environment. I offered a synthesis of studies of boomtown development, many of which find grounding in Gilmore's (1976) problem triangle that demonstrates how explosive resource extraction leads to a disruption in municipal economic development. I noted how mineral extraction takes place in non-United States contexts and those lessons that can be applied to the Eagle Ford Shale. I also summarized studies on mineral interests and offered reasons why geographers have, thus far, failed to use mineral appraisal data to quantitatively analyze economic development outcomes.

I used two main methods to accomplish my objectives. First, I conducted semi-structured interviews with 15 economic development officials from the Eagle Ford Shale. The questions directly queried economic development, industry labor practices,

and royalty distribution. These interviews were coded using a grounded approach finding emergent themes. I additionally used data acquired from two participant-observation conferences to augment my data on economic development practices. Second, I used 2010-2015 mineral interest assessments for property tax purposes as a proxy for relative Live Oak County mineral ownership. After data processing, I conducted spatial analyses and visualizations in ArcGIS. By focusing on one year's data (2015), I could examine relative mineral wealth concentration among individuals and firms as well as the spatial concentration of mineral wealth.

The semi-structured interviews indicate that Eagle Ford economic development officials are most concerned over the deterioration of local roads, the lack of permanent housing, the glut of short to extended stay lodgings, and how skyrocketing wages are negatively influencing the workforce. Respondents also examined how other policy domains—such as tax policy, economic development goals, and the nature of firm-local government partnerships—are manifest in the three primary economic development ramifications. I also noted how respondents perceived of split estates in their jurisdictions. I concluded that section by reconciling the Gilmore (1976) problem triangle into a modern context that can be applicable to other boomtown settings as well as provide an explanatory tool for what social scientists see on the landscape.

The results from the analysis of mineral wealth seem to imply that mineral owners, defined by their tax address, are spatially concentrated in a few key locations as described by statistical tests. Furthermore, wealth is spatially concentrated in a few major cities—mostly major Texas urban areas. This wealth is further concentrated in a

few key oil and gas firms that hold vast sums of mineral wealth as demonstrated by relatively high Gini coefficients. One company in particular, Burlington Resources, holds more than 30% of the total mineral wealth of the county. Additionally, temporal analyses reveal that local mineral interest owners and holders have decreasing relative amounts of mineral wealth since 2011. Despite increased petroleum production from Live Oak County, the total mineral wealth has decreased significantly due to diminished oil prices.

I link the mineral wealth analysis and interpretation of semi-structured interviews together through several theoretical angles. First, the mineral wealth analysis offers a fresh angle on fracking economic impact studies. The findings suggest a changing relationship between core Texas metropolitan regions and the peripheral Eagle Ford Shale. The concentration of mineral wealth into the hands of a few absentee owners and holders means that previous studies of mineral wealth may have exaggerated the amount of local ownership. I also investigate how stakeholders in the Eagle Ford Shale perceive mineral wealth through the royalty paradox. This leads me to suggest how political and social relationships may be changing with absentee mineral ownership. Finally, I counter claims that oil and gas extraction in the Eagle Ford has avoided a resource curse scenario.

7.2 Future Studies

The social and economic ramifications of modern fracking are still poorly known, but this thesis has indicated that mineral wealth appraisal data offers the potential to

contribute to longstanding debates on the resource curse; moreover, qualitative interviews with municipal and county officials can potentially advance Gilmore's problem triangle. Given fracking's ability to transform the physical and human landscape, a broad research agenda is a requisite for future studies. Geographers have methodological tools that merge qualitative and quantitative approaches, which can contribute to fruitful discussions of modern boomtown resource extraction. In this way, geographers offer the spatial research findings that can refine existing approaches put forth by other social and physical scientists (Lave and Lutz 2014; Willow and Wylie 2014; Calvert 2015). For example, important boomtown econometric estimates could be enhanced if it incorporated findings on the amount of local mineral ownership or the consequences to municipalities that is only gained through interviews with economic development officials. These multi-faceted approaches to boomtown research gain importance given the nature of tight-lipped oil and gas firms. Cross-disciplinary collaboration will be key, and I encourage the use of unconventional data, such as public mineral appraisal wealth or using qualitative data to interrogate resource curse mechanisms.

Using the themes I have developed in this thesis, there are still many opportunities for future research. First, the influence of oil prices on stakeholder views is worth considering. Given the precipitous drop in oil prices, 65% (as of December 2015) below the June 2014 value, economic development stakeholder views may have shifted. Are they still as optimistic about the economic ramifications of resource development? Are they concerned that they may have overspecialized in energy? What are the steps

being taken to insulate their jurisdictions from the negative shocks of the oil and gas industry retrenchment?

Future investigations of mineral ownership data should examine why there is such a significant disparity between the present study and other royalty studies of the Eagle Ford Shale and beyond. Is Live Oak County unique or is the methodology employed by other studies flawed? To engage with mineral ownership more rigorously, a regional investigation using several county appraisal districts should be undertaken. Unfortunately, there is no consistency in how these data are reported by appraisal districts (Section 3.6), so researchers would face significant obstacles in data processing. In spite of this issue, future fracking impact studies could use this publicly available appraisal data, which is a major improvement on estimations based on local *surface* estate ownership or a percentage of total oil and gas production.

7.3 Final Thoughts

The Eagle Ford Shale region has been transformed since the Dora Maria and STS-241 were first drilled in October 2008, which launched one of the largest onshore oil discoveries in 21st century North America. As oil prices have decreased since June 2014, so has the amount of drilling taking place on the Eagle Ford. Yet, economic development leaders were excited by the promising shale plays geologically underneath the Eagle Ford. Additionally, the Eagle Ford may gain importance as the U.S. begins to export oil and gas to non-free trade countries for the first time in 40 years as per federal legislation passed in December 2015 (Blum 2015). Additionally, a liquefied natural gas

(LNG) export facility in Corpus Christi is slated to open in 2018. Given that most petroleum firms have been targeting the liquids in the play (oils and condensates), significant reserves of natural gas remain and have yet to be exploited. New market accessibility could spur local demand for Eagle Ford natural gas and breathe new life into a slowed boom. The Eagle Ford Shale will continue to play an important role in U.S.—and soon global—energy markets for decades, resulting in a dynamic future for south Texas economic development.

This is why it is important for scientists continue to examine the ramifications of fracking through conversations with economic development officials and the incorporation of mineral wealth studies. While this thesis has noted that elements of the resource curse are potentially present in the Eagle Ford, future investigations are needed. Researchers should link qualitative findings from these conversations with quantitative results, such as the distribution of mineral ownership, as another way to examine resource extraction. This research can help frame where economic benefits accrue and whether localities are truly the sites of long term economic uplift that oil and gas firms purport. These critical and collaborative approaches are a necessity as fracking technologies augment hydrocarbon yields from previously neglected shales.

REFERENCES

Anderson, B. J., and G. L. Theodori. 2009. Local leaders' perceptions of energy development in the Barnett shale. *Southern Rural Sociology* 24 (1):113–129.

Armijo, S. 2014. *Texas small land sales report*. Austin, Texas: Texas Association of Realtors. https://www.texasrealestate.com/uploads/files/general-files/2014SmallLandSalesReportTAR.pdf.

Aroca, P., and M. Atienza. 2011. Economic implications of long distance commuting in the Chilean mining industry. *Resources Policy* 36 (3):196–203.

Auty, R. 1993. *Sustaining development in mineral economies: the resource curse thesis*. Routledge.

Auty, R. M. 2001. *Resource abundance and economic development.* Oxford ; New York : Oxford University Press, 2001.

Baker, J. 2014. Kenedy Lofts bringing luxury corporate apartments to downtown Kenedy. http://mysoutex.com/bookmark/25454259-Kenedy-Lofts-bringing-luxury-corporate-apartments-to-downtown-Kenedy (last accessed 11 September 2015).

Barnes, T. J., and R. Hayter. 2005. No "Greek-Letter Writing": local models of resource economies. *Growth and Change* 36 (4):453–470.

Barnes, T. J., R. Hayter, and E. Hay. 2001. Stormy weather: cyclones, Harold Innis, and Port Alberni, BC. *Environment and Planning A* 33 (12):2127–2147.

Barton, J. R., R. N. Gwynne, and W. E. Murray. 2008. Transformations in resource peripheries: an analysis of the Chilean experience. *Area* 40 (1):24–33.

Batheja, A. 2013. Fix for roads in shale counties might be short. *The Texas Tribune*. http://www.texastribune.org/2013/06/04/shale-counties-could-be-back-2015-needing-more-fun/ (last accessed 4 August 2015).

Batt, S. 2014. Gini index of income inequality for U.S. Counties | Outside the neatline. *University of Connecticut, University Libraries*. http://blogs.lib.uconn.edu/outsidetheneatline/2014/01/28/gini-index-of-income-inequality-for-u-s-counties/ (last accessed 21 March 2016).

Bebbington, A. 2012. Extractive industries, socio-environmental conflicts and political economic transformations in Andean America. In *Social conflict, economic development and extractive industries: Evidence from South America*, Routledge ISS Studies in Rural Livelihoods. Abingdon, United Kingdom: Routledge.

Bebbington, A. J., and J. T. Bury. 2009. Institutional challenges for mining and sustainability in Peru. *Proceedings of the National Academy of Sciences of the United States of America* 106 (41):17296–17301.

Besser, T. L., N. Recker, and K. Agnitsch. 2008. The impact of economic shocks on quality of life and social capital in small towns. *Rural Sociology* 73 (4):580–604.

Blanchard, B. 2014. Old ruling keeps counties from tapping oil money to fix roads. *The Texas Tribune*. http://www.texastribune.org/2014/12/22/old-ruling-keeps-counties-mineral-rights/ (last accessed 5 August 2015).

Blum, J. 2015. Here's the first known U.S. crude oil cargo destined for export. *Fuel Fix*. http://fuelfix.com/blog/2015/12/31/heres-the-vessel-carrying-the-first-known-crude-oil-for-export/#33542101=0&37107101=0 (last accessed 30 January 2016).

Brannstrom, C., and P. R. Brandão. 2012. Two hundred hectares of good business: Brazilian agriculture in a themed space. *Geographical Review* 102 (4):465–485.

Brannstrom, C., M. Tilton, A. Klein, and W. Jepson. 2015. Spatial distribution of estimated wind-power royalties in West Texas. *Land* 4 (4):1182.

Brasier, K. J., M. R. Filteau, D. K. McLaughlin, J. Jacquet, R. C. Stedman, T. W. Kelsey, and S. J. Goetz. 2011. Residents' perceptions of community and environmental impacts from development of natural gas in the Marcellus Shale: a comparison of Pennsylvania and New York cases. *Journal of Rural Social Sciences* 26 (1):32–61.

Brasier, K. J., D. K. McLaughlin, D. Rhubart, R. C. Stedman, M. R. Filteau, and J. Jacquet. 2013. Risk perceptions of natural gas development in the Marcellus Shale. *Environmental Practice* 15 (02):108–122.

Bridge, G. 2001. Resource triumphalism: postindustrial narratives of primary commodity production. *Environment and Planning A* 33 (12):2149–2174.

Bridge, G. 2008. Global production networks and the extractive sector: governing resource-based development. *Journal of Economic Geography* 8 (3):389–419.

Bridge, G., and A. Wood. 2005. Geographies of knowledge, practices of globalization: learning from the oil exploration and production industry. *Area* 37 (2):199–208.

Brown, J. P., T. Fitzgerald, and J. G. Weber. 2015. *Capturing rents from natural resource abundance: private royalties from US onshore oil & gas production*. Kansas City, MO: Federal Reserve Bank of Kansas City.

Brown, R. B., S. F. Dorins, and R. S. Krannich. 2005. The boom‐bust‐recovery cycle: dynamics of change in community satisfaction and social integration in Delta, Utah. *Rural Sociology* 70 (1):28–49.

Brown, R. B., H. R. Geetsen, and R. S. Krannich. 1989. Community satisfaction and social integration in a boomtown: a longitudinal analysis. *Rural Sociology* 54 (4):568–586.

Buchele, M. 2015. Why is Cotulla full of empty hotels? *Meanwhile, In Small Texas Towns*. http://smalltowntexas.kut.org/cotulla/cotulla-hotels.

Bury, J., and A. Bebbington. 2013. New geographies of extractive industries in Latin America. In *Subterranean struggles: New geographies of extractive industries in Latin America*, 27–66. Austin, Texas: University of Texas Press.

Calvert, K. 2015. From “energy geography” to “energy geographies”: Perspectives on a fertile academic borderland. *Progress in Human Geography*. http://phg.sagepub.com/content/early/2015/01/13/0309132514566343.abstract.

Capitol Appraisal Group. 2012. Understanding your appraised value. *Capitol Appraisal Group*. http://cagi.com/WebSite/pointers.htm (last accessed 12 December 2015).

Castillo-Swallow, S. 2015. Texas Eagle Ford Shale Magazine: Overview. *LinkedIn: Texas Eagle Ford Shale Magazine*. https://www.linkedin.com/company/texas-eagle-ford-shale-magazine (last accessed 3 August 2015).

Catton, W. R. 1982. *Overshoot: The ecological basis of revolutionary change*. University of Illinois Press.

Chapa, S. 2015. Top 10 hotels in the Eagle Ford Shale. *San Antonio Business Journal*. http://www.bizjournals.com/sanantonio/blog/eagle-ford-shale-insight/2015/06/top-10-hotels-in-the-eagle-ford-shale-based-on-tax.html (last accessed 18 September 2015).

Chew, K. J. 2014. The future of oil: unconventional fossil fuels. *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences* 372 (2006):1–34.

Coleman, G., J. Cyrier, L. Schubert, M. Geanie, C. Byron, G. Ryan, and C. Uresti. 2015. *HB 2521: Relating to the allocation and use of payments received under oil and gas leases of land owned by the state for a county road.*

Collins, A. R., and K. Nkansah. 2015. Divided rights, expanded conflict: split estate impacts on surface owner perceptions of shale gas drilling. *Land Economics* 91 (4):688–703.

Coomber, K., J. W. Toumbourou, P. Miller, P. K. Staiger, S. A. Hemphill, and R. F. Catalano. 2011. Rural adolescent alcohol, tobacco, and illicit drug use: a comparison of students in Victoria, Australia, and Washington State, United States. *The Journal of Rural Health* 27 (4):409–415.

Cope, M. R., J. Flaherty, K. D. Young, and R. B. Brown. 2015. Olympic boomtown: The social impacts of a one-time mega-event in Utah's Heber Valley. *Sociological Spectrum* 35 (2):136–160.

Creswell, J. W. 2012. *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Crowe, J., T. Silva, R. G. Ceresola, A. Buday, and C. Leonard. 2015. Differences in public perceptions and leaders' perceptions on hydraulic fracturing and shale development. *Sociological Perspectives* 58 (3):441–463.

Cuba, N., A. Bebbington, J. Rogan, and M. Millones. 2014. Extractive industries, livelihoods and natural resource competition: Mapping overlapping claims in Peru and Ghana. *Applied Geography* 54:250–261.

Cumbers, A. 1995. North Sea oil and regional economic development: the case of the North East of England. *Area* :208–217.

Danner, P. 2015. Eagle Ford bank deposits haven't slowed down, yet. *Houston Chronicle*. http://www.houstonchronicle.com/business/energy/article/Eagle-Ford-bank-deposits-haven-t-slowed-down-yet-6110174.php (last accessed 14 February 2016).

Darby, D., K. Jim, P. King, S. Thompson, and O. René. 2015. *HB 40: Relating to the exclusive jurisdiction of this state to regulate oil and gas operations in this state and the express preemption of local regulation of those operations.* http://txlege.texastribune.org/84/bills/HB40/.

Davis, C. 2012. The politics of "fracking": Regulating natural gas drilling practices in Colorado and Texas. *Review of Policy Research* 29 (2):177–191.

Davis, C., and K. Hoffer. 2012. Federalizing energy? Agenda change and the politics of fracking. *Policy Sciences* 45 (3):221–241.

Davis, G. A. 2010. Learning to love the Dutch disease: evidence from the mineral economies. *World Development* 23 (10):1765–1779.

DrillingInfo. 2015. DI Courthouse. *Drillinginfo*. http://1dhqyu3drpye39jm482ecnjl.wpengine.netdna-cdn.com/wp-content/uploads/2015/07/ROI_DICourthouseLeasing_Q215_Final-Web.pdf (last accessed 9 December 2015).

Durham, L. 2010. Eagle Ford joins shale elite. *AAPG*. http://www.aapg.org/publications/news/explorer/details/articleid/2695/eagle-ford-joins-shale-elite (last accessed 30 July 2015).

EIA. 2013. *U.S. crude oil and natural gas proven reserves*. Washington D.C. http://www.eia.gov/naturalgas/crudeoilreserves/.

———. 2014. *Updates to the EIA Eagle Ford play maps*. Washington, D.C.: Energy Information Administration. http://www.eia.gov/maps/pdf/EIA%20Eagle%20Ford%20Play%20update%2012-29-14.pdf (last accessed 7 August 2015).

———. 2015a. March 2015 Eagle Ford Region drilling productivity report. http://www.eia.gov/petroleum/drilling/pdf/eagleford.pdf.

———. 2015b. Petroleum and other liquids spot prices. http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm (last accessed 1 October 2015).

———. 2015c. *Top 100 U.S. oil and gas fields*. Washington, D.C.: U.S. Energy Information Administration. http://www.eia.gov/naturalgas/crudeoilreserves/top100/pdf/top100.pdf (last accessed 30 July 2015).

Emel, J., and R. Roberts. 1995. Institutional form and its effect on environmental change: The case of groundwater in the Southern High Plains. *Annals of the Association of American Geographers* (4):664.

Enervest. 2015. Enervest Profile. *Profile*. http://www.enervest.net/about-us/profile.html (last accessed 18 January 2016).

England, J. L., and S. L. Albrecht. 1984. Boomtowns and social disruption. *Rural Sociology* 49 (2):230–246.

Ennis, G., M. Tofa, and M. Finlayson. 2014. Open for business but at what cost? Housing issues in "boomtown" Darwin. *Australian Geographer* 45 (4):447–464.

ESRI. 2013. How Spatial Autocorrelation (Global Moran's I) works. *ArcGIS Resources*. http://resources.arcgis.com/EN/HELP/MAIN/10.1/index.html#//005p0000000t000000 (last accessed 18 December 2015).

Ewers, M. C. 2015. Oil, human capital and diversification: the challenge of transition in the UAE and the Arab Gulf States. *The Geographical Journal*. http://dx.doi.org/10.1111/geoj.12138.

Fehling, D. 2012. Why the legislature may target drillers' overweight trucks. *StateImpact Texas*. https://stateimpact.npr.org/texas/2012/11/06/legislature-may-target-drilling-industrys-overweight-trucks/ (last accessed 23 March 2016).

Finer, M., B. Babbit, S. Novoa, F. Ferrarese, S. Eugenio Pappalardo, M. De Marchi, M. Saucedo, and A. Kumar. 2015. Future of oil and gas development in the western Amazon. *Environmental Research Letters* 10 (2):024003.

Fisher Heck Architects. 2015. Karnes County Courthouse restoration. *Karnes County Courthouse Restoration*. http://www.fisherheck.com/karnes-county-courthouse-restoration/ (last accessed 4 October 2015).

Fox San Antonio. 2014. *Eagle Ford Shale boom or bust?* San Antonio, Texas: Fox San Antonio. https://www.youtube.com/watch?v=M-zGK0J2xvQ (last accessed 20 January 2016).

Francis, K. 2008. Petrohawk focuses firmly on the Haynesville. *Prospects and Properties* 19 (12):7.

Frankel, J. A. 2010. *The natural resource curse: a survey*. Cambridge, MA: National Bureau of Economic Research.

Freudenburg, W., and R. Gramling. 1998. Linked to what? Economic linkages in an extractive economy. *Society & Natural Resources* 11 (6):569–586.

Fry, M. 2013. Urban gas drilling and distance ordinances in the Texas Barnett Shale. *Energy Policy* 62:79–89.

Fry, M., and C. Brannstrom. 2015. Op-Ed: Preemption and scalar politics, from living wages to hydraulic fracturing. *AAG Newsletter*. http://news.aag.org/2015/03/preemption-and-scalar-politics/ (last accessed 18 September 2015).

Fry, M., C. Brannstrom, and T. Murphy. 2015. How Dallas became frack free: hydrocarbon governance under neoliberalism. *Environment and Planning A* 47:2591–2608.

Fry, M., A. Briggle, and J. Kincaid. 2015. Fracking and environmental (in) justice in a Texas city. *Ecological Economics* 117:97–107.

Gilmore, J. S. 1976. Boom towns may hinder energy resource development. *Science* 191 (4227):535–540.

Goldberg, D. 2015. Texas A&M Geoservices. *Texas A&M University Geoservices*. http://geoservices.tamu.edu (last accessed 1 October 2015).

Gold, R. 2014. *The boom: How fracking ignited the American energy revolution and changed the world*. New York, NY : Simon & Schuster.

Gramling, B., and S. Brabant. 1986. Boomtowns and offshore energy impact assessment the development of a comprehensive model. *Sociological Perspectives* 29 (2):177–201.

Guerra, K., K. Dahm, and S. Dundorf. 2011. *Oil and gas produced water management and beneficial use in the Western United States*. Denver, Colorado: U.S. Department of the Interior, Bureau of Reclamation. https://www.usbr.gov/research/AWT/reportpdfs/report157.pdf (last accessed 2 October 2015).

Gylfason, T. 2001. Natural resources, education, and economic development. *15th Annual Congress of the European Economic Association* 45 (4–6):847–859.

Had to Know. 2016. Gini coefficient calculator. *Had to Know*. http://www.had2know.com/academics/gini-coefficient-calculator.html (last accessed 21 March 2016).

Haggerty, J., P. H. Gude, M. Delorey, and R. Rasker. 2014. Long-term effects of income specialization in oil and gas extraction: The US West, 1980–2011. *Energy Economics* 45:186–195.

Halseth, G., and L. Sullivan. 2004. From Kitimat to Tumbler Ridge: A crucial lesson not learned in resource-town planning. *Western Geography* 13 (14):132–60.

Harrison, B. 1997. The effects of state and local public policies on economic development: panel on policy implications. *New England Economic Review* :1–12.

Haslam Mckenzie, F. 2013. Delivering enduring benefits from a gas development: governance and planning challenges in remote Western Australia. *Australian Geographer* 44 (3):341–358.

Hayter, R., T. J. Barnes, and M. J. Bradshaw. 2003. Relocating resource peripheries to the core of economic geography's theorizing: rationale and agenda. *Area* 35 (1):15–23.

Heinkel-Wolfe, P. 2015. HB 40 could set off change. *Denton Record-Chronicle*. http://www.dentonrc.com/local-news/local-news-headlines/20150502-hb-40-could-set-off-change.ece (last accessed 10 August 2015).

Hester, T. 1996. Live Oak County. In *The new handbook of Texas*, ed. D. E. Barnett, 242–245. Austin, Texas: Texas State Historical Association.

Hiller, J. 2010. Shale now is as good as gold. *San Antonio Express-News*. http://www.mysanantonio.com/business/local/article/Shale-now-is-as-good-as-gold-705518.php (last accessed 20 January 2016).

———. 2014. Work continues on Eagle Ford roads, pipelines. *San Antonio Express-News*. http://www.expressnews.com/business/eagle-ford-energy/article/Work-continues-on-Eagle-Ford-roads-pipelines-5879361.php (last accessed 4 August 2015).

Hoover's. 2016. Enervest Operating, L.L.C. *Enervest Operating, L.L.C. Company Overview*. http://subscriber.hoovers.com/H/company360/overview.html?companyId=929022069 (last accessed 18 January 2016).

Huber, M. 2015. Theorizing energy geographies. *Geography Compass* 9 (6):327–338.

Hudgins, A., and A. Poole. 2014. Framing fracking: private property, common resources, and regimes of governance. *Ecology* 21:222–348.

Humphreys, M., J. Sachs, and J. E. Stiglitz. 2007. *Escaping the resource curse*. New York : Columbia University Press, [2007].

Hurt III, H. 1981. New Oil: The Giddings Gamble. *Texas Monthly*. http://www.texasmonthly.com/story/new-oil-giddings-gamble?fullpage=1.

Innis, H. A. 1929. The teaching of economic history in Canada. *Contributions to Canadian Economics* :52–68.

Isham, J., M. Woolcock, L. Pritchett, and G. Busby. 2005. The varieties of resource experience: natural resource export structures and the political economy of economic growth. *The World Bank Economic Review* 19 (2):141–174.

Jacquet, J. 2009. Energy boomtowns & natural gas: Implications for Marcellus Shale local governments & rural communities. *NERCRD Rural Development*.

Jacquet, J. B. 2014. Review of risks to communities from shale energy development. *Environmental Science & Technology* 48 (15):8321–8333.

James, A., and D. Aadland. 2011. The curse of natural resources: An empirical investigation of U.S. counties. *Choices & the Environment: Essays in Honor of Thomas D. Crocker* 33 (2):440–453.

Jarmon, C. A., J. M. Vanderleeuw, M. S. Pennington, and T. E. Sowers. 2012. The role of economic development corporations in local economic development evidence From Texas Cities. *Economic Development Quarterly* 26 (2):124–137.

Johnston, J. E., E. Werder, and D. Sebastian. 2016. Wastewater disposal wells, fracking, and environmental injustice in Southern Texas. *American Journal of Public Health* :e1–e7.

Kassover, J. 1981. Resource development, rural communities and rapid growth: Managing social change in the modern boomtown. *Minerals and the Environment* 3 (2):47–54.

Kay, D. 2011. *The economic impact of Marcellus Shale gas drilling, What have we learned? What are the limitations?* Cornell University. http://www2.cce.cornell.edu/naturalgasdev/documents/pdfs/kayformattedmarcellus%20workingpaperrevised4-4-2011.pdf (last accessed 9 December 2015).

Kelsey, T. W., M. Shields, J. R. Ladlee, and M. Ward. 2011. Economic impacts of Marcellus Shale in Pennsylvania: Employment and income in 2009. *University Park: Pennslyvania State University Extension*.

Keough, S. B. 2015. Planning for growth in a natural resource boomtown: challenges for urban planners in Fort McMurray, Alberta. *Urban Geography* :1–28.

Kinnaman, T. C. 2011. The economic impact of shale gas extraction: A review of existing studies. *Ecological Economics* 70 (7):1243–1249.

Klopott, F. 2015. N.Y. officially bans fracking with release of seven-year study. *Bloomberg News*. http://www.bloomberg.com/news/articles/2015-06-29/n-y-officially-bans-fracking-with-release-of-seven-year-study (last accessed 18 January 2016).

Kolstad, I., and A. Wiig. 2009. It's the rents, stupid! The political economy of the resource curse. *Energy Policy* 37 (12):5317–5325.

Lacho, K. J., D. B. Bradley III, and M. Cusack. 2006. Business nonprofits: helping small businesses in New Orleans survive Katrina. *The Entrepreneurial Executive* 11:55.

Lacho, K. J., and E. N. Brockmann. 2015. Business training opportunities from chambers of commerce. *Academy of Entrepreneurship Journal* 21 (1):93–101.

Lambert, D., J. A. Gale, and D. Hartley. 2008. Substance abuse by youth and young adults in rural America. *The Journal of Rural Health* 24 (3):221–228.

Larsen, E. R. 2006. Escaping the resource curse and the Dutch Disease? *American Journal of Economics and Sociology* 65 (3):605–640.

Lave, R., and B. Lutz. 2014. Hydraulic fracturing: A critical physical geography review. *Geography Compass* 8 (10):739–754.

Lawrie, M., M. Tonts, and P. Plummer. 2011. Boomtowns, resource dependence and socio-economic well-being. *Australian Geographer* 42 (2):139–164.

Livengood, K. R. 1983. Value of big game from markets for hunting leases: The hedonic approach. *Land Economics* 59 (3):287–291.

Lucas, R. A. 1971. *Minetown, milltown, railtown life in Canadian communities of single industry*. Toronto: Toronto University of Toronto Press.

Malewitz, J. 2014a. In oil country, one town peers beyond the boom. *The Texas Tribune*. http://www.texastribune.org/2014/11/07/heart-eagle-ford-karnes-city-peers-beyond-boom/ (last accessed 13 October 2015).

———. 2014b. The Texas energy revolt. *Politico Magazine*. http://www.politico.com/magazine/story/2014/12/texas-fracking-ban-113575.html (last accessed 10 August 2015).

Maqbool, A. 2015. The Texas town that banned fracking (and lost). *BBC News*. http://www.bbc.com/news/world-us-canada-33140732 (last accessed 10 August 2015).

Marin, A., L. Navas-Alemán, and C. Perez. 2015. Natural resource industries as a platform for the development of knowledge intensive industries. *Tijdschrift voor Economische en Sociale Geografie* 106 (2):154–168.

Martineau, D. F. 2007. History of the Newark East field and the Barnett Shale as a gas reservoir. *AAPG bulletin* 91 (4):399–403.

McMullen County Independent School District. 2014. *Notice of Bond Election*. http://www.mcisd.us/2014NoticeofBondElectionEnglish.pdf.

Mehlum, H., K. Moene, and R. Torvik. 2006. Institutions and the resource curse. *The Economic Journal* 116 (508):1–20.

Mercer, A., K. de Rijke, and W. Dressler. 2014. Silences in the boom: coal seam gas, neoliberalizing discourse, and the future of regional Australia. *Ecology* 21:222–348.

Michaels, G. 2011. The long term consequences of resource‐based specialisation. *The Economic Journal* 121 (551):31–57.

Miller, N. 2015. Commissioners amend road project. *Odessa American*. http://www.oaoa.com/premium/article_1bc56108-e7a6-11e4-b18a-9b8c1033b192.html (last accessed 4 August 2015).

Mitchell, T. 2006. Society, economy, and the state effect. *The Anthropology of the State: A Reader* :169–86.

Murphy, T. 2014. *Barnett shale municipal oil and gas ordinance dynamics: A spatial perspective* Undergraduate Thesis. College Station, Texas: Texas A&M University.

———. 2015a. Eagle Ford cities should prepare for economic roller coaster. *San Antonio Express-News*. http://www.mysanantonio.com/opinion/commentary/article/Eagle-Ford-cities-should-prepare-for-economic-6092629.php (last accessed 8 October 2015).

———. 2015b. Reality bites in the Eagle Ford region. *Houston Chronicle* 6 March. http://www.chron.com/opinion/outlook/article/Reality-bites-in-the-Eagle-Ford-region-6119815.php (last accessed 6 March 2015).

———. 2016. Who owns LOC's mineral wealth? *The Progress* 9 March.

Naber, M. 2013. Courthouse windows to cost half-million. *Beeville Bee Picayune*. http://www.mysoutex.com/view/full_story/23872863/article-Courthouse-windows-to-cost-half-million? (last accessed 4 October 2015).

Naismith Engineering, Inc. 2015. *DeWitt County road damage cost allocation study*. Corpus Christi, Texas.

http://tools.cira.state.tx.us/users/0041/DeWitt%20County%20Road%20Damage%20Cost%20Allocation%20Study.pdf (last accessed 5 August 2015).

Neary, J. P., and S. van Van Wijnbergen. 1986. *Natural resources and the macroeconomy. 1st MIT Press ed.* Cambridge, Mass.: MIT Press.

Nord, M., and A. E. Luloff. 1993. Socioeconomic heterogeneity of mining-dependent counties. *Rural Sociology* 58 (3):492–500.

Orta-Martínez, M., and M. Finer. 2010. Oil frontiers and indigenous resistance in the Peruvian Amazon. *Ecological Economics* 70 (2):207–218.

Papyrakis, E., and R. Gerlagh. 2007. Resource abundance and economic growth in the United States. *European Economic Review* 51 (4):1011–1039.

Pasqualetti, M. J. 2009. The Alberta oil sands from both sides of the border. *Geographical Review* 99 (2):248–267.

Pasqualetti, M. J., and M. A. Brown. 2014. Ancient discipline, modern concern: geographers in the field of energy and society. *Energy Research & Social Science* 1:122–133.

Pearson, K. 2012. *Geologic Models and Evaluation of Undiscovered Conventional and Continuous Oil and Gas Resources— Upper Cretaceous Austin Chalk, U.S. Gulf Coast*. Reston, Virginia: U.S. Geological Survey. http://pubs.usgs.gov/sir/2012/5159/SIR12-5159.pdf (last accessed 30 July 2015).

Peck, J., and A. Tickell. 2002. Neoliberalizing space. *Antipode* 34 (3):380–404.

Peluso, N. L., and M. Watts. 2001. *Violent environments*. Cornell University Press.

Perreault, T. 2006. From the Guerra Del Agua to the Guerra Del Gas: resource governance, neoliberalism and popular protest in Bolivia. *Antipode* 38 (1):150–172.

———. 2013. Nature and nation: hydrocarbon, governance, and the territorial logics of "Resource Nationalism" in Bolivia. In *Subterranean struggles: new geographies of extractive industries in Latin America*, 67–90. Austin, Texas: University of Texas Press.

Perry, M., and J. E. Rowe. 2015. Fly-in, fly-out, drive-in, drive-out: The Australian mining boom and its impacts on the local economy. *Local Economy* 30 (1):139–148.

Phillips, K., and J. Cañas. 2011. Texas economy moves from recovery to expansion. *Southwest Economy of the Federal Reserve Bank of Texas* First Quarter.

Pirtle, C. 2011. *Gamble in the Devil's Chalk : the battle for oil in a field of broken dreams.* Hideaway, Texas : Venture Galleries LLC.

Pope, C. A. 1985. Agricultural productive and consumptive use components of rural land values in Texas. *American Journal of Agricultural Economics* 67 (1):81–86.

Pope, C. D., and P. J. Handren. 1992. Completion techniques for horizontal wells in the Pearsall Austin Chalk. *SPE Production Engineering* 7 (2):144–148.

Pruitt, L. R. 2008. *The forgotten fifth: rural youth and substance abuse*. Rochester, NY: Social Science Research Network. http://papers.ssrn.com/abstract=1279669 (last accessed 4 October 2015).

Quiroga, C., E. Fernando, and J. Oh. 2012. *Energy developments and the transportation infrastructure in Texas: Impacts and strategies*. College Station, Texas: Texas A&M Transportation Institute. http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/0-6498-1.pdf (last accessed 4 August 2015).

Quiroga, C., and I. Tsapakis. 2015. *Oil and gas energy developments and changes in crash trends in Texas*. College Station, Texas: Texas A&M Transportation Institute. http://static.texastribune.org/media/documents/RecentAM.pdf (last accessed 9 October 2015).

Quiroga, C., I. Tsapakis, E. Kraus, J. Le, and A. Wimsatt. 2015. *Oil and gas energy developments and changes in pavement conditions in Texas*. College Station, Texas: Texas A&M Transportation Institute.

Rabe, B. G., and P. A. Mundo. 2007. Business Influence in State-Level Environmental Policy. *Business and Environmental Policy: Corporate Interests in the American Political System* :265–294.

Rahm, D. 2011. Regulating hydraulic fracturing in shale gas plays: The case of Texas. *Energy Policy* 39 (5):2974–2981.

Rahm, D., B. Fields, J. L. Farmer, and D. Ramsey. 2015. Transportation impacts of fracking in the Eagle Ford Shale Development in rural south Texas: Perceptions of local government officials. *The Journal of Rural and Community Development* 10 (2):78–99.

Railroad Commission. 2015a. Eagle Ford Shale information. http://www.rrc.state.tx.us/oil-gas/major-oil-gas-formations/eagle-ford-shale/ (last accessed 1 December 2015).

———. 2015b. Oil and gas exploration and surface ownership. http://www.rrc.state.tx.us/about-us/resource-center/faqs/oil-gas-exploration-and-surface-ownership/ (last accessed 14 February 2016).

Rehner, J., S. A. Baeza, and J. R. Barton. 2014. Chile's resource-based export boom and its outcomes: Regional specialization, export stability and economic growth. *Geoforum* 56:35–45.

Riley, T. 2007. Wrangling with urban wildcatters: defending Texas municipal oil and gas development ordinances against regulatory takings challenges. *Vermont Law Review* 32 (2):349–405.

Rodrik, D., A. Subramanian, and F. Trebbi. 2004. Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth* 9 (2):131–165.

Rosa, E. A., G. E. Machlis, and K. M. Keating. 1988. Energy and society. *Annual Review of Sociology* :149–172.

Rosenmai, P. 2012. Lorenz curve graphing tool & Gini coefficient calculator. *Peter Rosenmai Blog*. http://www.peterrosenmai.com/lorenz-curve-graphing-tool-and-gini-coefficient-calculator (last accessed 21 March 2016).

Ross, M. L. 1999. The political economy of the resource curse. *World Politics* 51 (02):297–322.

Rousu, M. C., D. Ramsaran, and D. Furlano. 2015. Guidelines for conducting economic impact studies on fracking. *International Advances in Economic Research* 21 (2):213–225.

Sachs, J. D., and A. M. Warner. 1995. *Natural Resource Abundance and Economic Growth*. Cambridge, MA: National Bureau of Economic Research. http://www.nber.org/papers/w5398.

Sachs, J. D., and A. M. Warner. 2001. The curse of natural resources. *European Economic Review* 45 (4):827–838.

Sarraf, M., and M. Jiwanji. 2001. *Beating the resource curse: the case of Botswana*. The World Bank. https://openknowledge.worldbank.org/bitstream/handle/10986/18304/multi0page.pdf?sequence=1&isAllowed=y (last accessed 8 February 2016).

Sawyer, S. 2004. *Crude chronicles: Indigenous politics, multinational oil, and neoliberalism in Ecuador*. Duke University Press.

Schade, G. W., and G. S. Roest. 2015. Is the shale boom reversing progress in curbing ozone pollution? *Eos* 96. https://eos.org/opinions/is-the-shale-boom-reversing-progress-in-curbing-ozone-pollution (last accessed 19 October 2015).

Schafft, K. A., Y. Borlu, and L. Glenna. 2013. The relationship between Marcellus Shale gas development in Pennsylvania and local perceptions of risk and opportunity. *Rural Sociology* 78 (2):143–166.

Schapiro Group. 2012. *The real value of joining a local chamber of commerce a research study*. Atlanta, Georgia: The Schapiro Group, American Chamber of Commerce Executives In cooperation, and the Western Association of Chamber Executives. http://www.lbccc.org/documents/SchapiroUpdated_DEC2012.pdf (last accessed 18 December 2015).

Schmidt, W. 1981. Western boom towns obtain aid from mining companies. *The New York Times* 24 July. http://www.nytimes.com/1981/07/24/us/western-boom-towns-obtain-aid-from-mining-companies.html (last accessed 20 December 2015).

Sider, A. 2014. What is condensate? Introducing America's new oil export. *The Wall Street Journal* 25 June. http://blogs.wsj.com/corporate-intelligence/2014/06/25/what-is-condensate-introducing-americas-new-oil-export/ (last accessed 11 December 2015).

Silva, T. J., and J. A. Crowe. 2015. The hope-reality gap: rural community officials' perceptions of unconventional shale development as a means to increase local population and revitalize resource extraction. *Community Development* :1–17.

Simonelli, J. 2014. Home rule and natural gas development in New York: civil fracking rights. *Journal of Political Ecology* 21 (1):258–78.

Smith, M. 2011. Latest school finance challenges resigned to Robin Hood. *The Texas Tribune*. http://www.texastribune.org/2011/12/02/robin-hood-accepted-reality-texas-schools/ (last accessed 1 October 2015).

Smith, M. D., R. S. Krannich, and L. M. Hunter. 2001. Growth, decline, stability, and disruption: A longitudinal analysis of social well‐being in four western rural communities. *Rural Sociology* 66 (3):425–450.

Southwick, A., and R. Southwick. 2007. *The 2001 economic benefits of hunting, fishing, and wildlife watching in Texas*. Fernandina Beach, Florida: Southwick Associates, Inc. https://tpwd.texas.gov/publications/nonpwdpubs/media/tx_fish_hunt_wl_view_economics.pdf (last accessed 21 March 2016).

Stedman, R. C., J. B. Jacquet, M. R. Filteau, F. K. Willits, K. J. Brasier, and D. K. McLaughlin. 2012. Environmental reviews and case studies: Marcellus Shale gas development and new boomtown research: Views of New York and Pennsylvania residents. *Environmental Practice* 14 (4):382–393.

Storey, K. 2001. Fly-in/fly-out and fly-over: mining and regional development in Western Australia. *Australian Geographer* 32 (2):133–148.

Texas Association of Counties. 2015. The function of Texas county government. *Texas County Government*. https://www.county.org/texas-county-government/county-govt-structure/Pages/Function.aspx (last accessed 10 August 2015).

Texas Comptroller of Public Accounts. 2013. *Live Oak County Appraisal District 2013-2014 Reappraisal Plan*. Austin, Texas. http://comptroller.texas.gov/taxinfo/proptax/13-14reappraisals/liveoak149_13-14.pdf.

Texas Constitution and Statutes. 1986. *Texas Election Code*. http://www.statutes.legis.state.tx.us/Docs/EL/htm/EL.1.htm#1.005.

Texas Drilling. 2015. Oil wells and production in Live Oak County. *Live Oak County*. http://www.texas-drilling.com/live-oak-county (last accessed 9 December 2015).

Texas House of Representatives House Research Organization. 2013. *Major Issues of the 83rd Legislature, Regular Session, and First, Second and Third Called Sessions*. Austin, Texas: Texas House of Representatives. http://www.lrl.state.tx.us/scanned/sessionoverviews/major/major83.pdf.

Texas Legislature Online. 2015. HB 40. *HB 40*. http://www.legis.state.tx.us/BillLookup/History.aspx?LegSess=84R&Bill=HB40 (last accessed 14 December 2015).

Texas Municipal League. 2015. A guide to becoming a city official. *Texas Municipal League*. http://www.tml.org/p/AGuidetoBecomingaCityOfficial2015Web.pdf (last accessed 8 October 2015).

Theodori, G. l. 2012. Public perception of the natural gas industry: Data from the Barnett Shale. *Energy Sources: Part B, Economics, Planning and Policy* 7 (3):275–281.

Theriot, R. 2012. A quick primer on mineral rights. In *State Bar of Texas: New Frontiers in Marital Property Law*. New Orleans, Louisiana: State Bar of Texas http://www.texasbarcle.com/materials/special/2.2_theriot.pdf (last accessed 9 December 2015).

Three Rivers Independent School District. 2014. *Order calling a bond election*. http://www.trisd.org/district/elections/Election_Order_modified%20for%20posting_2.pdf.

Tonts, M. 2010. Labour market dynamics in resource dependent regions: an examination of the Western Australian goldfields. *Geographical Research* 48 (2):148–165.

Tonts, M., P. Plummer, and M. Lawrie. 2012. Socio-economic wellbeing in Australian mining towns: A comparative analysis. *Journal of Rural Studies* 28 (3):288–301.

Torres, N., Ó. Afonso, and I. Soares. 2013. *A survey of literature on the resource curse: critical analysis of the main explanations, empirical tests and resource proxies*. Universidade do Porto, Faculdade de Economia do Porto.

Torvik, R. 2002. Natural resources, rent seeking and welfare. *Journal of Development Economics* 67 (2):455–470.

Tunstall, T. 2014. Economic impact of the Eagle Ford Shale. *Petroleum Accounting and Financial Management Journal* 33 (2):11–22.

———. 2015a. Eagle Ford and the State of Texas. In *Economics of unconventional shale gas development*, 121–148. Springer.

———. 2015b. Recent economic and community impact of unconventional oil and gas exploration and production on South Texas Counties in the Eagle Ford Shale Area. *Journal of Regional Analysis & Policy* 45 (1):82.

Tunstall, T., J. Oyakawa, H. Eid, C. Medina, M. Green Jr., I. Sanchehez, R. Rivera, J. Lira, and D. Morua. 2014. *Economic impact of the Eagle Ford Shale*. San Antonio: University of Texas at San Antonio.

TXOGA. 2015. House Bill 40. *TXOGA*. https://www.txoga.org/house-bill-40/ (last accessed 14 December 2015).

Walker, R. A. 2001. California's golden road to riches: natural resources and regional capitalism, 1848–1940. *Annals of the Association of American Geographers* 91 (1):167–199.

Watts, M. J. 2005. Righteous oil? Human rights, the oil complex, and corporate social responsibility. *Annual Review of Environmental Resources* 30:373–407.

Way, K. 2015. *House bill 40 passes Texas Senate, Heads to governor's desk*. Austin, Texas: Texas Independent Producers and Royalty Owners Association. http://www.tipro.org/UserFiles/05.04.15_TIPRO_Statement.pdf (last accessed 14 December 2015).

Weber, B., A., J. Geigle, and C. Barkdull. 2014. Rural North Dakota's Oil Boom and Its Impact on Social Services. *Social Work* 59 (1):62–72.

Weber, J. G. 2012. The effects of a natural gas boom on employment and income in Colorado, Texas, and Wyoming. *Energy Economics* 34:1580–1588.

———. 2014. A decade of natural gas development: The makings of a resource curse? *Resource and Energy Economics* 37:168–183.

Weber, J. G., J. P. Brown, and J. Pender. 2013. *Rural wealth creation and emerging energy industries: lease and royalty payments to farm households and businesses*. Federal Reserve Bank of Kansas: The Federal Reserve Bank of Kansas City Research Working Paper.

White, N. 2012. A tale of two shale plays. *The Review of Regional Studies* 42 (2):107–119.

Wilkinson, K. P., J. G. Thompson, R. R. Reynolds, and L. M. Ostresh. 1982. Local social disruption and western energy development a critical review. *Sociological Perspectives* 25 (3):275–296.

Willow, A., and S. Wylie. 2014. Politics, ecology, and the new anthropology of energy: exploring the emerging frontiers of hydraulic fracking. *Journal of Political Ecology* 21 (12):222–236.

Wilson, L. J. 2004. Riding the resource roller coaster: understanding socioeconomic differences between mining communities. *Rural Sociology* 69 (2):261–281.

Wynveen, B. J. 2011. A thematic analysis of local respondents' perceptions of Barnett Shale energy development. *Journal of Rural Social Sciences* 26 (1):8–31.

APPENDIX A

Interview Framework: Eagle Ford Shale Public Policies and Economic Development

Interviews will begin after reading, signing, and discussing the Informed Consent Form. **Question five in the consent form asks: What will I be asked to do in this study?** Begin by following up on that question.

Respondent Code: **EFS -** _____

A. Respondent Background

Obtain **professional credentials of respondent:**
Elected or career official? Head of organization?
Expertise or credentials [degree; training; experience]?
How long in current position [years or months]? How long in this community [years or months]?

Does your office (eg Chamber of Commerce, Planning Department) have plans for expansion?

→ be specific: workers, space, activities?...in response to ….?

Is there a "culture" in this community regarding oil and gas development?
-Related to past oil production?
-Related to mineral rights ownership?

What is/was your role in economic development, policy, or relations with oil and gas production in your community?

[Allow for respondent to discuss this answer in his/her own terms]

Who are/were the key figures involved in economic development, policy, or relations with oil and gas production in your city/town/county? When (years, months)? [prompts: municipal officials; elected officials; industry representatives; prominent citizens; external figures]

B. County, City or Town Ordinances

Are you familiar with ordinances that regulate some aspect of oil and gas development (eg roads, water disposal, setback distances, housing, zoning, etc.)

Year established_____ by whom_____ year revised _____ by whom_____
Key aspects:

Outside Consultants: Were outside consultants involved in helping establish these ordinances?

Who? ….. Role?....

If policy created, then: **Use these cards to rank the importance of the following objectives as they were raised during the establishment and/or amendment of policies regarding oil and gas:**

_____Prevent noise complaints (___)

_____Preserve home property values (___)

_____Protect public safety (___)

_____Protect public health (___)

_____Encourage mineral production (___)

_____Reduce exposure to regulatory takings lawsuit (___)

Ordinance outcomes:

After the implementation of the ordinances, were there lawsuits, conflicts, or litigation?

Have there been complaints about oil/gas production or related activities?

What was the nature of the complaints?

Were these before or after the adoption of the ordinances?

C. Partnerships

Describe partnerships between your community, office or organization with oil and gas firms

→ define "partnerships" as relationship, agreement, affiliation, etc., for workforce training, housing, logistical, social, etc.

→ ask for specific examples, for example, Have oil and gas companies provided any support (financial, volunteer, or otherwise) to the community? How would you describe your relations with the companies?

Which oil and gas companies are most prevalent in your community in terms of partnerships with public officials?

D. Economic Development

Please list and rank the 3-5 most important aspects of oil and gas-related economic development for your community

Rank	Aspect of oil/gas economic development	Rationale

E. Workforce

Do oil and gas firms (upstream and midstream) hire local or outside labor? (ask respondent to define "local")

What types of education are desired or required for jobs in your community?

Which sector of oil and gas development presents the greatest challenges for obtaining workers?

Are there locations/times that EFS management and workers in multiple firms share their experiences and discuss the happenings in their companies? (Perhaps at a conference or bar?)

Do EFS companies prefer to talk with you [city official] directly or is there a preference towards other communication mediums (i.e. phone, email, text, physical mail)?

Do workers move frequently between firms? Or between up and mid-stream sectors? Do firms have difficulty with retention of workers?

In your community, could you provide examples oil/gas affecting upward mobility (social and occupational)? Do workers leave your community for upward mobility?

Where is most worker training carried out? [job site, at a branch location on the EFS, or at other locations?]

For what type of jobs are local laborers trained? Do these workers supply pre-oil/gas demands, such as work on farms and ranches?

F. Future of Eagle Ford Shale

Describe your view of the future of oil and gas-related development for your community

→ why does respondent holds these views? How do they define "future"? How do they define "development"?

→ which obstacles might impede future development?

G. Conclusion [remind respondents that all questions are voluntary and they may opt out of any question]

Do you have mineral interests in the Eagle Ford Shale?

Did most landowners in this community retain their mineral rights?

Are there particular individuals within the companies with whom you routinely communicate? Would you recommend us contacting them?

Earlier, we asked about worker retention. How long do you think oil/gas companies and their workers will remain in your community?

APPENDIX B

Code List used in Atlas.ti

Social Disruption
Future Development/Future Workforce
Workforce Education
Royalty/Tax Acceptance (Institution)
Growth (Institutionally Guided)
Industry Civic Involvement and Relations
Industry Leaders-No Analysis Needed
Residential Royalties
Workforce Training
Regulations
Workforce Inadequate
Workforce Transient
Interviewee Background-Incorporated in Spreadsheet
Inter-Institutional Network
Workforce Mobility
Growth (Unguided Institutionally)
Historical Drilling
Workforce Origins
Workforce Upward Mobility-Not strong enough responses to do analysis
Inter-Institution Tension
Reliance on Oil Price
Inter-Firm Network
Development Ranking
Recommended Contact
Royalty Utilization (Institution)
Infrastructure Improvement