SHALE GAS ENVIRONMENTALITIES: A CRITICAL Q METHODOLOGY ANALYSIS OF FARMING, KNOWLEDGE, AND THE POLITICS OF BINARIES IN THE MARCELLUS SHALE BASIN

by

GRETCHEN SNEEGAS

(Under the Direction of HILDA E. KURTZ)

ABSTRACT

This dissertation examines the politics of environmental knowledge at the intersection of shale gas development and agricultural production in the Marcellus Shale region. The lack of a comprehensive federal shale gas development policy has created a heterogeneous landscape of state regulations, with neighboring states such as New York and Pennsylvania adopting opposing regulatory approaches: New York has banned hydraulic fracturing, while Pennsylvania has drilled over 11,000 wells over a ten-year period. Using this region as a timely and compelling case study, this dissertation examines the politics of contestation among farmer-landowners, agricultural researchers, and Cooperative Extension educators seeking to navigate the Marcellus shale gas boom. Conceptually, I employ environmentality frameworks to navigate the shifting, uneven, and contextually contingent networks of environmental knowledges, discourses, institutions, and politics that co-produce farmer-landowners as shale gas subjects. However, pervasive pro/anti-drilling and economy/environment dichotomies frame public debate over shale gas development, obscuring the complex interactions of power and knowledge that produce partial subject positions with myriad orientations towards hydraulic fracturing. I argue that

farmer-landowners who own their subsurface mineral rights are situated at the confluence of multiple, competing arts of governance that seek to shape their behavior, resulting in incomplete, precarious, and contradictory multi-subjectivities.

INDEX WORDS: Q Methodology, Shale Gas Development, Environmental Knowledge, Governmentality, Agriculture, Political Ecology

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DEDICATION

For M.S.P., C.J.S., J.A.S., A.M.S.P., and E.M.S.

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CHAPTER 1

INTRODUCTION:

ENCOUNTERING AND NAVIGATING PERTURBATIONS OF SHALE GAS DEVELOPMENT

1.1 Introduction

I first saw the robotic dairy in November 2013. Located about an hour south of Pittsburgh, Pennsylvania, the farm looked like any other mid-sized conventional dairy operation in the region: muddy drive, a picturesque 19th century farmhouse, and multiple outbuildings with a large silo. Hills rose behind the barn and farmhouse, covered with acres of brown corn stalks waiting to be harvested for sileage. As the farmer led me on a tour, I watched in fascination while cows let themselves into small chambers where they stood patiently, eating a small molasses and grain ration as robotic arms used lasers to find their udders. The farmer proudly explained how precision dairying technology kept track of individual cow-level data on milk quality and quantity. Later as we sat in his kitchen, his phone buzzed – a notification from the dairy computer, telling him that a cow needing veterinary attention was being held in one of the milking stalls. As we chatted at the kitchen table, my questions piled up: Are other dairies installing this technology in the area? Has it improved your business, your quality of life? How much did this cost? And finally – especially important in a business famous for its highly volatile commodity prices – how did you pay for all this expensive equipment?

I learned then that the farmer had installed the precision dairying technology with money from leasing his subsurface mineral rights for shale gas development. “They were real nice

checks for a while," he mused. "We had checks early on for forty thousand a month…And now they've kind of flatlined. And they normally average about $4,000 a month." He explained that their farm was the first in their township to lease in 2008, back at the start of the Pennsylvania shale gas boom. I peered out the kitchen window, surprised not to see any heavy industrial equipment, and the farmer pointed out a winding dirt road that led past the hills looming behind the barn. That was where the well pad sat, hidden from view by rolling hills and rustling, dried corn stalks.

On its surface, this vignette appears to perfectly illustrate a common narrative deployed by the shale gas industry: that shale gas development can help "save family farms" by paying down debt and helping farmers modernize their equipment. This narrative further articulates with the discursive motif of the "struggling family farm," a trope that continues to be circulated through such headlines as "American farmers are in crisis" (Chrisman, 2018); "Farmers are struggling to make ends meet. This controversial policy could help" (Douglas, 2018); and "The latest blow to struggling family farms: Rising interest rates" (Long, 2018). Together, these themes present both the problem, and a potential solution: American farmers are in trouble, but shale gas can rescue them.

Shale gas development via hydraulic fracturing, known colloquially as "fracking," comprises a suite of related and relatively new technologies used to extract natural gas from shale rock formations deep beneath the surface of the earth. However, the benefits and risks of shale gas development remain hotly contested in the public imaginary. Anti-fracking activists claim that landowners and communities experiencing shale gas extraction are subjected to environmental degradation, increased economic inequality, public health concerns, and infrastructural damage (Small et al., 2014). Oil and gas companies, however, argue that natural

gas development promotes national energy security, acts as a "bridge fuel" to renewable resource development, and pumps money into communities through job creation, landowner royalties and signing bonuses (PIOGA, 2019). But whether one views shale gas development as beneficial or detrimental, there is little doubt that the U.S. shale gas boom continues to present a radical perturbance to agricultural regions situated over natural gas-bearing formations such as the Marcellus Basin.

The Marcellus Shale Basin, which stretches beneath much of Pennsylvania, New York, West Virginia, and Ohio, is considered the largest extractable source of natural gas in the U.S. However, hydraulic fracturing has been *de facto* banned in New York state since 2008. In this way, New York contrasts sharply with the neighboring state of Pennsylvania, where over 11,000 wells have been drilled as of December 31, 2018 (PA DEP, 2019). These two states provide a timely and compelling case study to investigate how shale gas development via hydraulic fracturing disturbs rural human-environment interactions, viewed through the lens of agricultural production.

The Marcellus shale gas boom, which began in earnest in 2008, has created a dynamic landscape where the intersections of shale gas and farming open up new sites of friction, disturbance, and conflict. Farmer-landowners must navigate these rapid changes and find new ways of interacting with(in) these newly perturbed landscapes. The juxtaposition of shale gas and farming exposes tensions over projected benefits and risks relating to shale gas development in rural regions. While concerns over water contamination, air quality, and other environmental degradation issues have loomed large in the shale gas debate (Sneegas, 2016), other contested domains include competition for resources such as labor, water, and land; highly uneven per-acre signing bonuses and royalty payments to farmers leasing their subsurface mineral rights; and

concerns over changes to the community in terms of its livability and rural character (Hitaj et al., 2014). Farmer-landowners exhibit multiple orientations towards shale gas development due to the divergent state-level regulatory landscape of New York and Pennsylvania: agricultural producers may have embraced or contested hydraulic fracturing, leased their land and regret their decision, chose not to lease land but have neighbors who did, or may be unable to lease land despite wishing to. Such diverse orientations continue to (re)shape the agricultural landscape, as well as farmers' relationships to the landscape, in multiple and dynamic ways.

Yet, portrayals of shale gas development in the popular media tend to reduce this complex topic to an overly simplistic dichotomy, corralling varied, overlapping, and contradictory positions into a reductive and unproductive either/or binary. Shale gas development is portrayed as either good for the economy or bad for the environment, particularly at the juncture of shale gas and farming. By reducing diverse perspectives through a dualistic frame, binary discourses such as the shale gas debate lock stakeholders into predetermined narratives, thereby erasing alternative perspectives and knowledges, and foreclosing potential solutions and sites of convergence. In particular, farmers must conform to a narrative that discursively juxtaposes the environmental well-being of their land against the financial fitness of their business. Such narrow dualisms erase ways of knowing and experiencing shale gas development that do not conform to its binary schema, thereby concealing the uneven ways in which the process is transforming agricultural landscapes.

To transgress these reductive representations and identify overlapping and hybrid orientations farmer-landowners may have towards shale gas development, in this dissertation I develop and deploy "critical Q methodology," a combination of standard Q methodology (Q), critical discourse analysis (CDA), and semi-structured interviews. Standard Q methodology

merges qualitative and quantitative approaches to measure subjectivity by identifying shared worldviews within complex and contested discourses like those related to shale gas and agriculture. I bring standard Q together with CDA to make Q more attentive to the uneven social and power relations in which perspectives and discourses are generated, circulated, and reproduced. I view critical Q as an ideal method for analyzing and comparing diverse environmental subject positions, as this approach facilitates a robust analysis of how certain environmental subjectivities align with different discourses and forms of knowledge (Robbins, 2006; Jepson et al., 2012). By comparing how different participants respond across the New York/Pennsylvania state border in the Twin Tiers region, I use critical Q to identify how shared worldviews at the shale gas/farming juncture emerge which outline the contours of diverse and overlapping environmental subjectivities, how these subjectivities align with and use myriad discourses and forms of environmental knowledge, and how farmer-landowners know and experience shale gas extraction in intersecting and diverging ways.

I also use critical Q to deconstruct the overly simplistic division of shale gas development through either/or frames. In earlier research, I examined how the "family farm" is deployed as an appealing, static symbol by multiple stakeholders across the shale gas debate (Sneegas, 2016). However, by using critical Q to identify perspectives which transgress reductionist binaries, this dissertation demonstrates how farmer-landowners occupy multiple and overlapping orientations towards shale gas development which transect the overly simplistic either/or boundaries through which the debate is framed. By using critical Q to highlight and interrogate the messy, contradictory viewpoints at the shale gas/farming intersection, I aim to disrupt portrayals of farmers as a homogenous stakeholder group and complicate reductive representations of both farming and shale gas development as a whole.

The complex negotiations occurring at the juncture of shale gas and farming prompt a number of tantalizing questions: how do farmer-landowners make decisions about whether to lease their subsurface mineral rights for shale gas extraction, and what forms of environmental knowledge do they draw on to do so? How do the divergent regulatory landscapes of New York and Pennsylvania shape farmers' perspectives about the shale gas development process? What institutions seek to control the production and circulation of knowledge and discourse at the farming/shale gas intersection, and to what ends? Together, these questions outline the contours of the central research question driving my dissertation research, which asks: *How are farmers being hailed as environmental subjects at the confluence of agriculture and shale gas?*

1.2 Dissertation outline

To answer these questions, I conduct a comparative case study of the New York southern tier and Pennsylvania northern tier – known as the "Twin Tiers" region – to better understand how farmer-landowners are responding to the perturbations of shale gas development within and upon agricultural landscapes. In **Chapter 2** I outline the conceptual framework which I use to analyze whether and how farmers' environmental relationships are changing in response to the perturbations of shale gas development. Primarily, I employ an environmentality framework (Agrawal, 2005), which examines how environmental subjectivities are co-produced in tandem with knowledge, institutions, and politics. Environmentality conceptualizes the "environment" as a socially constructed domain of meaning, in which individuals are created as subjects via different configurations of state power. Drawing from Foucauldian governmentality (Foucault 2007, 2008), an environmentality framework analyzes how individuals are disciplined into behaving in certain ways in relation to the environment, resulting in distinct "environmental subjectivities."

In this chapter, I argue that an environmentality optics facilitates a uniquely supple analysis of the shifting, uneven, and contextually contingent networks of environmental knowledge, politics, and institutions which together shape environmental subject positions. I also outline two central interventions to the environmentality framework. First, I integrate a close attention to discourse as the medium with and through which environmental politics, knowledge, institutions, and subjectivities are co-produced. Second, I incorporate science and technology studies into the environmentality literature in order to facilitate a more thorough theorization of knowledge production, circulation, application, and erasure as key processes which simultaneously enable and constrain the co-production of farmer-landowners as environmental subjects. I also integrate concepts from agro-food studies to understand how the agricultural technology treadmill is deployed as a technology of government, contributing to the production of divergent agricultural and shale gas environmentalities.

In **Chapter 3**, I summarize the background information required to understand the debate over shale gas development, particularly in relation to agricultural production. The chapter begins with an overview of shale gas development via hydraulic fracturing and its history, then reviews the existing scholarly literature examining the impacts of shale gas extraction on the agricultural sector. I also outline the historically and contextually contingent developments which have situated farmer-landowners as key "geological gatekeepers" within the Twin Tiers region. Finally, I examine the political processes which have come together to produce the divergent regulatory landscapes of New York and Pennsylvania, even as the region shares certain economic, geologic, and social trajectories.

I outline the study methodology in **Chapter 4**. To analyze the complex interactions through an environmentality optics, I develop and deploy "critical Q method," an innovative

mixed methods approach combining Q methodology (Q), critical discourse analysis (CDA), and semi-structured interviews. The first half of the chapter delineates the theoretical foundation for critical Q, and investigates four productive moments of synergy and tension where CDA and standard Q protocol may be productively brought into conversation. I argue that critical Q offers a unique and valuable methodology for analyzing environmental subject positions, as it is able to "render empirical" certain hard-to-measure concepts such as knowledge and subjectivity (Robbins, 2006). In the second half of the chapter, I describe how I use a critical Q approach to design and implement my dissertation project. Specifically, I illustrate how critical Q allows me to deconstruct the reductive pro/anti-drilling binaries which shape discursive representations of shale gas development.

Chapter 5 presents the results of the dissertation's critical Q study, which identifies four distinct worldviews relating to shale gas and agriculture among the study participants: balanced rationalists, environmental protectionists, extraction enthusiasts, and skeptical individualists. I present the results as a long-form narrative interpretation of each worldview, with representative quotations drawn from the semi-structured interviews to provide added nuance and context. I examine how these four worldviews are organized along intersecting dichotomies of collectivism/individualism, economic/environmental impact, and pro/anti-drilling orientation. I end the chapter by exploring the patterns of consensus and divergence between the worldviews, asking to what degree the Q study results deconstruct the polarized framing which dominates popular media portrayals of shale gas development.

The first analysis chapter, **Chapter 6**, examines how the study participants demographically align with the four identified worldviews, and what patterns emerge which illustrate flows of discourse and knowledge among study participants. I interpret these patterns to

outline how circuits of discourse are organized within and between the four worldviews, with knowledge forming a central discursive representation in the context of the shale gas debate. I explore how these networks are shaped and governed by three significant institutions – private property regimes, the oil and gas industry, and the Cooperative Extension service – and explore how leases acts as a boundary object deployed within each institutional domain as an instrument of knowledge which codifies and reproduces landowner-industry relations. These institutions come together to produce farmer-landowners as "geological subjects" (Braun, 2000) whose decisions whether or not to lease their subsurface mineral rights poses important consequences for the acquisition and commodification of shale gas resources.

Chapter 7, the second analysis chapter, examines each of the four worldviews produced through the Q study (Chapter 5) through an environmentality analytic by exploring how each represents a distinct form of environmental subject. I deploy Fletcher's (2010) Foucauldian typology of conservation environmentalities to examine how each worldview is produced with and through the "interplay" of multiple, co-existing arts of environmental governmentality. I argue that study participants are always already formed as environmental subjects, and that the perturbations of shale gas development map onto their preexisting subject positions to create new sites of friction, resistance, and accord between unstable and shifting multi-subjectivities. I focus particularly on the agricultural technology treadmill as a neoliberal technology of government, which articulates with other disciplinary, sovereign, and "truth" environmentalities to interpellate farmer-landowners as divergent forms of shale gas subjects. In so doing, I use critical Q to deconstruct a dichotomous view of shale gas subjectivity as either for or against, and examine how study participants are instead formed at the confluence of multiple, competing exercises of power to enact partial, incomplete, and hybrid environmental subjectivities.

Lastly, I conclude the dissertation in **Chapter 8** by reflecting on the promises and limits of this dissertation broadly, and critical Q methodology specifically. I discuss its limits and contradictions, as well as the kinds of analysis it produces and makes possible. I also reflect on some of my choices throughout the research design and production process, how they have shaped this dissertation, and how my own views on shale gas development and agriculture continue to evolve. In this way, I hope to situate critical Q not only as a unique and useful methodological approach, but also as a means to consider our own positionalities as knowledge producers.

I end by revisiting the discursive narrative of the struggling family farm saved by shale gas development. I examine how this representation constitutes an act of "dog whistle politics" (Lopez, 2015) where the struggling family farm represents a coded racial narrative of a diminished white, conservative America. After discussing the intersecting axes of privilege and oppression which situate "struggling family farms" within the political economy of agriculture and energy, I explore the shale gas debate in the larger context of a Trump-era political landscape. I argue that the height of the shale gas debate, circa 2012, presaged many of the themes which played out during the 2016 U.S. Presidential election, including how the politics of binaries have been – and continue to be – leveraged to consolidate power.

CHAPTER 2

ANALYTICAL FRAMEWORK

2.1 Introduction

The shale gas "boom" in the Marcellus Shale region is rapidly perturbing agricultural landscapes and (re)shaping human-environment relations in regions of shale gas development. In this chapter, I outline my theoretical framework through which I examine these disturbances. I situate the dissertation research within an environmentality theoretical framework (Agrawal, 2005; Fletcher, 2010) to navigate the shifting, uneven, and contextually contingent networks of environmental knowledges, politics, discourses, and institutions which together co-produce farmer-landowners as environmental subjects in the context of shale gas development. I integrate environmentality with science and technology studies (STS) and agro-food studies approaches to investigate farmers' environmental subjectivities relative to shale gas, and how the process of environmental subject formation facilitates and/or hinders the process of "making" and commodifying shale gas resources.

An environmentality approach facilitates a uniquely supple and nuanced examination of the shifting, uneven, and contextually contingent networks of environmental knowledges, institutions, policies, and discourses which together shape environmental subjectivities and practices. Specifically, I employ environmentality to examine circulations of environmental *knowledge* across, within, and through agricultural landscapes; the role of private property regimes, oil and gas industry, and Cooperative Extension as key knowledge-generating and communicating *institutions*; how these processes and landscapes are differentially shaped by

divergent state-level shale gas *policies*; and how these variables together influence the dynamic formation of farmer environmental *subjectivities*. As a central theoretical intervention to the environmentality scholarship, I also integrate *discourse* as a key mediating factor between different nodes in the framework. Specifically, I examine knowledge as a fundamental discursive representation that facilitates translation within and across the environmentality network.

Incorporating STS into the environmentality framework also facilitates a more thorough theorization of the role of knowledge and knowledge-generating institutions in shaping farmer-landowners' environmental subjectivities. By using STS, I explore the boundary-work enacted by various stakeholders and institutions in the shale gas debate which seek to interpellate farmer-landowners as particular kinds of environmental subjects. Finally, using agro-food studies, I conceptualize the agricultural technology treadmill as a key Foucauldian *technology of governance* shaping the environmental practices of farmer-landowners, agricultural researchers, and Cooperative Extension educators. Together, this dissertation deploys these conceptual frameworks to examine how farmer-landowners emerge as environmental subjects in the confluence of competing and overlapping shale gas environmentalities.

2.2 Making shale gas resources

The shale gas "boom" of the past decade has been a major perturbance to rural regions in the U.S. where extraction occurs. The Marcellus Shale Basin, as an especially productive region of shale gas development stretching beneath much of Pennsylvania, West Virginia, Ohio, and New York, has experienced a concurrent profusion of scholarly work investigating various dimensions of the region's shale gas "boom". This highly productive body of work includes such topics as public attitudes and perceptions (Davis and Fisk, 2014; Clarke et al., 2016; Choma et al., 2016); the discursive framing of pro- and anti-drilling narratives (Hudgins and Poole, 2014;

Mazur, 2016); shale gas governance (Negro, 2012; Smith and Ferguson, 2013; Rabe, 2014; Davis, 2014; Simonelli, 2014; Goldthau, 2016); and contested domains of risk and resistance (Bamberger and Oswald, 2012; Sovacool, 2014). Together, these works examine the consequences, both beneficial and detrimental, of shale gas development for rural communities within the Marcellus region.

Within this profusion of shale gas research in the social sciences, a nascent body of scholarly work has begun to investigate the processes through which shale gas is known, made, and circulated as a commodity (Goldthau, 2016; Kama, 2016; Bridge and Bradshaw, 2017; Kuchler, 2017). This body of literature follows resource geographer Erich Zimmerman's (1933) claim that "resources are not: they become." From this perspective, resources are not essential objects that exist "out there" for human use – rather, resources are historically and socially contingent, the product of "cultural appraisals about utility and value" (Bridge, 2009, p. 1219). The prevailing view of resources as inherently "natural" obscures the processes through which they come to be seen and valued as a resource. As Bridge notes, "The fact that something…is regarded as a resource (or not) tells us rather more about a society than the substance itself" (2009, p. 1220). For example, fossil fuels carry little to no utility outside of an industrial capitalist society, where they are metabolized as highly prized commodities via a complex assemblage of scientific knowledge, technological infrastructure, market relations, and regulatory bodies (Bridge and Wood, 2005; Weszkalnys, 2013; Richardson and Weszkalnys, 2014).

Thus far, the "resource making" literature has largely focused on the processes by which fossil fuels are known, and thereby governed. The commodification and marketing of knowledge is shown to be an integral process to the making of fossil fuel resources, via "knowledge

economies" (Bridge and Wood, 2005) as well as physical technological infrastructure, and the expert knowledges which produce and mobilize them (Richardson and Weszkalnys, 2014). The processes of knowledge production, circulation, and use are an inherent part of resource governance, as Kuchler (2017) illustrates by tracing how practices of calculation and mapping have, in the Foucauldian sense, made shale gas reserves known and therefore governable. In this way, as both Elden (2013) and Bridge (2014) examine, states and quasi-state institutions territorialize "resource frontiers" such as shale gas formations, thereby rendering them legible to both capital and governing bodies as commodities.

I wish to address a gap within the "resource making" literature on shale gas, as well as the broader body of scholarly work examining the Marcellus Shale "boom" of the past decade. As the previous chapter outlined, fairly little research in the social sciences has been devoted to examining the intersection of shale gas development and agricultural production. This gap is reproduced in the resource making literature. While there have been calls for more attention to the "above ground factors" influencing shale gas development (Goldthau, 2016), such analyses have focused primarily on the role of policy and regulatory environments shaping shale gas extraction. Following Goldthau's intervention, I argue that other "above ground factors" also play crucial roles in the process of making shale gas resources. Few analyses are examining the role of rural landowners, much less farmers, play in the process of "making" shale gas as a resource, by choosing to lease their subsurface mineral rights in regions of shale gas development. In order to examine this question, I situate my analysis at the intersection of three theoretical literatures: environmentality, science and technology studies, and agro-food studies.

2.3 Governmentality of the environment: Environmentality

To better understand how farmer-landowners as a key stakeholder group are shaping how shale gas resources are "made," this dissertation employs an environmentality – or "governmentality of the environment" – framework. Environmentality (Agrawal, 2005; Fletcher, 2010, 2017), a form of Foucauldian governmentality, has emerged in recent years as a theoretical framework to analyze how populations are governed to behave in certain desirable ways, relative to the environment. Environmentality comprises one strand of the broader body of "governmentality studies" within the environmental governance literature, stemming from the fourth in a series of lectures given by Michel Foucault at the Collège de France in 1977-78. In this lecture, later published as the stand-alone "Governmentality" essay (1991), Foucault outlines the transition in governance following the "emergence of the problem of population," which developed alongside the great "demographic expansion" of the early Industrial Revolution (2007, p. 103-4). To effectively govern populations, governing bodies developed new tools and techniques, distinct from those of sovereign rulers whose primary objective was to "maintain, strengthen, and protect the [sovereign's] principality…constituted by the subjects and the territory" (ibid., p. 92). Foucault's early conceptualization of governmentality examines how people are formed into subjects of particular configurations of state power: in becoming a subject, citizens discipline themselves and each other into behaving in ways considered desirable by those in power (Foucault, 2007). Subjects are also disciplined via *technologies of government*, or "the various tools or mechanisms for governing such as the procedures, policies, techniques of calculation, laws, or processes of analysis, that enable authorities to shape, direct, and limit collective and individual agency" (Boer, 2017). As noted above, much of the shale gas governance literature has focused on "techniques of calculation" such as statistics, mapping, and

other forms of measurement that render populations, landscapes, and "nature" legible to governing bodies (Scott, 1998; Elden, 2007; Rose-Redwood, 2012). To understand this process, researchers must "understand the ensemble formed by institutions, procedures, analyses and reflections, calculations, and tactics that allow the exercise of this very specific, albeit very complex, power that has the population as its target" (Foucault, 2007, p. 108).

Within this body of literature, a narrower strand of "environmentality" literature has emerged, in which the concept of governmentality is applied to the construction of "the environment" as a domain invested with meaning and power (Luke, 1995; Darier, 1999; Rutherford, 2007; Gabrys, 2014). First coined by political scientist Timothy Luke (1995), environmentality in its broadest sense gestures to a "governmentality of the environment." Luke's research examines transnational environmental organizations such as the Worldwatch Institute, and the ways in which they work to discursively control global environmental and conservation activity. However, close attention to environmental subjectivity formation has come to be most widely associated with the work of Arun Agrawal (2005), who contends that that changes in governance, marked by new governance technologies, lead to emergent or altered environmental subjectivity formations.

In his conceptualization of environmentality, Agrawal argues that politics, institutions, and environmental subjectivities are "intimately linked," influencing each other simultaneously (2005, p. 3). In his case study of Kuamon in India, Agrawal uses this framework to show how the shift from a centralized, colonial state to decentralized, participatory governance resulted in the emergence of a new, conservation-focused environmental subjectivity among villagers in the region. Agrawal advances the environmentality framework as a critical intervention to address the shortcomings of other scholarly environmental governance studies, maintaining that analyses

which focus solely on one element (e.g. institutions, politics, etc.) are inherently distorted. Agrawal's central intervention is the close analysis of how environmental subjectivities are formed, with a focus on the role of situated social practices. According to Agrawal, environmental practices form "the key link between the regulatory rule that government is all about and imaginations that characterize particular subjects" (2005, p. 167). In other words, environmental knowledges, policies, institutions, and environmental subjectivities collectively co-produce the "tissue of contingent practices" that characterize different manifestations of environmentality (ibid., p. 167).

Since the publication of Agrawal's work, environmentality framework has been widely employed within the environmental governmentality literature (Haggerty, 2007; Birkenholtz, 2009; Mawdsley, 2009; Cepek, 2011; Gabriel, 2011; Jepson et al., 2012; Lora-Wainwright et al., 2012; Singh, 2013; Forsyth and Walker, 2014; Adams, 2015; O'Riordan et al., 2016; Orihuela, 2017; Lloro-Bidart, 2017; Bluwstein, 2017; Boer, 2017), with many scholars contributing their own critiques and interventions. For example, Cepek (2011) draws on ethnographic research with the indigenous Cofán people in Ecuador and Columbia to demonstrate that conservation programs funded by the Field museum failed to reshape environmental subjectivities among the project's Cofán participants. This finding leads Cepek to argue that Agrawal overestimates the power of "regulatory regimes that originate outside of the communities that practice them" (p. 504). Jepson et al. (2012) also argue that Agrawal overstates the capacity for "top-down" state power to alter environmental subject positions. Furthermore, Mawdsley (2009) questions Agrawal's apparent conflation of environmental subjectivity with progressive values, and whether environmentality inevitably results into "people who care about the environment." Rather, she notes that definitions of "good" or "desirable" environmental outcomes are "open to

ontological and epistemological uncertainty," making them key sites of negotiation and contestation (p. 242).

Likewise, multiple scholars claim that Agrawal's original framework does not sufficiently theorize the presence of resistance or individual agency. For example, Birkenholtz (2009) argues that subjects occupy "multiple axes of difference along which environmental actors accept or resist [state] efforts" (p. 212). Similarly, Jepson et al. (2012) find that Agrawal's framework presents "little conceptual space to understand the process of changing subjectivity when strangely held beliefs, or coherent counterclaims, challenge new institutional, regulatory, and enforcement practices" (p. 852). Further, Singh (2013) notes that many environmentality studies privileges top-down technologies of economic and political power, yet "pay insufficient attention to the role of affect, emotions, and embodied practices" which also shape environmental subjectivities (p. 189). From this perspective, Agrawal fails to consider the potential presence of overlapping or competing entities working to shape environmental citizens, or how these resulting subjectivities may be incomplete; experience uneven uptake; or result in unusual or hybrid discourses, subjectivities, and practices. Such interventions parallel broader critiques of Foucauldian governmentality overall for its seemingly "top-down" conceptualization of power as pervasive and inescapable, and the resulting lack of critical attention to the roles of agency and resistance to state power (O'Malley et al., 1997).

These critiques presage a major intervention that has deeply influenced the environmentality literature in recent years, following the English translation of Foucault's *The birth of biopolitics* lecture series in 2008. In these lectures, Foucault further develops and extends his conceptualization of governmentality, which was first widely read in his now-classic essay "Governmentality" (1991). The problem, as Fletcher (2010) points out, is that this essay was

extracted from a larger body of lectures, some of which have since been translated into English: *Society must be defended* (2003), *Security, territory, population* (2007), and *The birth of biopolitics* (2008). The last paragraph of *The birth of biopolitics* lecture series reads:

> In the modern world, in the world we have known since the nineteenth century, a series of governmental rationalities overlap, lean on each other, challenge each other, and struggle with each other: art of government according to truth, art of government according to the rationality of the sovereign state, and art of government according to the rationality of economic agents, and more generally, according to the rationality of the governed themselves. And it is all these different arts of government, all these different types of ways of calculating, rationalizing, and regulating the art of government which, overlapping each other, broadly speaking constitute the object of political debate from the nineteenth century. What is politics, in the end, if not both the interplay of these different arts of government with their different reference points and the debate to which these different arts of government gives rise? It seems to me that it is here that politics is born. (Foucault, 2008, p. 313)

As this excerpt demonstrates, rather than relying on his early formulation of governmentality, which "stood opposed to discipline" in the sovereignty-discipline-government trio, Foucault came to instead conceptualize governmentality as "a generic term" referring to multiple means of "conducting conduct" (Fletcher, 2010, p. 173). Foucault outlines here four "governmental rationalities" which can reinforce, intersect, and compete: 1) a *truth* governmentality, which he defines as "governing according to the knowledge of human and divine laws" which prescribe behaviors "in accordance to the order of things" (p. 311); 2) a *sovereign* governmentality, enacted through the threat of punitive action and "the calculation of force, relations, wealth, and factors of strength" (p. 311); 3) a *neoliberal* governmentality, guided by "the rationality of economic agents" (p. 313); and 4) a *disciplinary* governmentality, through which subjects govern themselves and each other through the diffusion of ethics and norms. Together, these shifting and dynamic modes of governance outline the uneven topographies of power through which subjectivities are formed.

It is also through the "interplay" between differing arts of government, or governmentalities, that politics – which I conceptualize here as the negotiations and contestations relating to power and influence – emerges. This process occurs through simultaneous, competing, and often contradictory exercises of power emanating from multiple sources – or, as Foucault describes, between "techniques of domination and techniques of the self" (Foucault, 1993, [cited in Lemke, 2001]). Foucault argues that the researcher

> has to take into account the points where the technologies of domination of individuals over one another have recourse to processes by which the individual acts upon himself. And conversely, he has to take into account the points where the techniques of the self are integrated into structures of coercion and domination. The contact point, where the individuals are driven by others is tied to the way they conduct themselves, is what we can call, I think, government. Governing people, in the broad sense of the word, governing people is not a way to force people to do what the governor wants; it is always a versatile equilibrium, with complementarity and conflicts between techniques which assure coercion and processes through which the self is constructed or modified by himself. (Foucault, 1993, p. 203-4)[1]

Placed into conversation with *The birth of biopolitics*, Foucault's comments delineate the contours of a highly dynamic political landscape. Diverse modes of governmentality layer onto one other, each seeking to promote certain forms of subjectivity. To hail subjects that enact preferred behaviors, these governmentalities deploy a variety of technologies of government, which may alternative align or conflict with exercises of power used by other governmentalities in service to other goals. In this way, examining Foucault's early "Governmentality" essay, and the large body of scholarship it has inspired, against his later scholarship (such as that examined here) begins to open up the conceptual space for a more nuanced exploration of subjectivity formation.

It is in this context that the environmentality literature has undergone a significant shift. Following the more widespread availability of Foucault's *The birth of biopolitics* series, Fletcher

[1] Excerpted from transcriptions of two lectures from November 1980, cited in Lemke, 2011.

(2010, 2017) adapts the framework of overlapping governmentalities into a typology of multiple, competing environmentalities at play within debates over biodiversity conservation: 1) *neoliberal* environmentality, relying on external market-based incentives to guide action; 2) *disciplinary* environmentality, which seeks to incentivize desired behaviors through internalized norms, morals, and values; 3) *sovereign* environmentality, which operates through top-down threats of punitive action; 4) an environmentality of "*truth*," exemplified by Fletcher through deep ecology's "claims concerning humans' essential interconnection with nature" (p. 177). To this typology, which adheres to Foucault's framing, Fletcher theorizes a fifth "liberation environmentality" emphasizing environmental justice, participation, collaboration, and anti-colonialism. Rather than existing in mutually exclusive spheres, Fletcher argues that these expressions of environmentality may in fact be co-constitutive: different environmentalities "may alternatively merge, divide, compete, conflict, or coexist within any given context" (p. 177). In this way, Fletcher argues that it is more accurate to view environmentality "as encompassing multiple overlapping forms" which seek to define and promote different environmental behaviors and practices, rather than a monolithic and totalizing exercise of power (Fletcher, 2017, p. 312). However, although Fletcher (2010) characterizes Agrawal (2005) as a form of *disciplinary* environmentality only, this dissertation argues that the underlying framework outlined by Agrawal – investigating applications of diverse exercises of power with and through environmental knowledges, politics, institutions, and subjectivities, and how these are co-produced within contingent, situated environmentality configurations – remains applicable for examining multiple, overlapping environmentalities.

Fletcher's intervention has given rise to a recent body of scholarly work analyzing environmental governance through the lens of the multiple governmentalities outlined in his

typology (Adams, 2015; O'Riordan et al., 2016, 2019; Lloro-Bidart, 2017; Bluwstein, 2017; Boer, 2017; Laforge and McLachlan, 2018; Asiyanbi et al., 2019). Such scholarship argues that it is more accurate to view subject formation as forged from the productive tensions between overlapping environmentalities which apply both repressive and productive sources of power. For instance, O'Riordan et al. (2016) examine the interplay of experiential, place-based knowledge and top-down peatland conservation policies to form "multi-subjectivities" among rural turf-cutters in Irish bog peatlands (p. 425). In a 2019 paper, the authors argue further that "the abandonment of sovereign environmentality" as a conservation approach leaves a regulatory void, in which neoliberal and "emergent" truth environmentalities articulate to shape conservation policy. Lloro-Bidart (2017) analyzes sustainable seafood education using Fletcher's Foucauldian typology, arguing that efforts such as the California Aquarium of the Pacific "Seafood for the Future" program invoke both neoliberal and disciplinary environmentalities: aquarium visitors are educated through a mixture of "disciplinary appeals (e.g. normalizing 'doing the right thing') and market-based approaches," which together promote supporting the sustainable seafood market as a viable conservation solution (p. 1183). In another example, Bluwstein (2017) explores how sovereign, neoliberal, and disciplinary environmentalities territorialize Tanzanian conservation zones in different ways, such that two divergent "ecosystem tourism models" emerge around land sharing and land appropriation approaches.

However, Fletcher's interpretation of Foucauldian governmentality has not gone unchallenged. For instance, Orihuela (2017) claims that thus far, the environmentality literature has focused "on the followers of environmental regulatory regimes rather than on the champions who transform state action" – or what he calls "environmentality entrepreneurs" (p. 52). Bresnihan (2019) actually questions the theoretical foundations of Fletcher's typology, arguing

that "governmentality has only ever been liberal…a mode of governing that operates on and through the individual, economic subject and economic rationalities" (p. 172). Bresnihan therefore diverges from Fletcher's reading of Foucault on the grounds that the "multiple governmentalities" approach is actually describing divergent tactics and technologies of government within an overarching liberal economic rationality, rather than encompassing opposing rationalities. However, I would argue that while an economic rationality may influence many – or most – manifestations of governmentality, it does not preclude the presence of alternative logics which can inform the means and objects of governance. Furthermore, by situating all governance within the liberal tradition, Bresnihan's argument fails to take into account non-Western means of conceptualizing and acting within the world. For instance, as Singh (2013) points out, governmentality scholars need to "look beyond economic and political rationalities" to inform their analyses.

To these critiques, I add three of my own. First, environmental subjectivity formation requires further theoretical work to understand and unpack its development as an inherently incomplete, uneven, and hybrid process. This dissertation conceptualizes participants as always already hailed as environmental subjects, with environmental subjectivity (re)production occurring at the nexus of multiple institutions, politics, and knowledges. From this perspective, all subjects are environmental subjects, although their conceptualizations of and relationships to "the environment" as a socially constructed domain may vary greatly. I argue that more work is needed to examine how new disturbances may upset and potentially reshape these pre-existing networks of institutions, knowledges, and politics that produce environmental subjectivities. Moreover, environmental subjectivities, and the environmentalities from which they emerge, are

frequently represented as fixed, stable, and complete. I would contend instead that these networks under analysis are precarious, even volatile, and never inevitable or linear.

Second, I argue that environmentality scholarship would greatly benefit from a more robust engagement with Foucauldian discourse analysis and the role of discursive regimes. This is a curious gap, given the environmentality literature's theoretical heritage within Foucault's work on governmentality and Foucault's own extensive scholarship on discourse. "Discourse" is a complex concept, which – like governmentality – Foucault himself defined differently over time (Waitt, 2010). However, a central aspect of Foucault's approach to discourse is examining "the production of knowledge through language" as an effect of power (Hall, 1992, p. 291; see also Chapter 4 of this dissertation). Foucault writes that discourses are "practices that systematically form the objects of which they speak" (1972, p. 49), facilitating the production and circulation of knowledge. Says Hall (2001), discourse "governs the way that a topic can be meaningfully talked about and reasoned about. It also influences how ideas are put into practice and used to regulate the conduct of others" (p. 71). Foucault's conceptualization of knowledge/power is thus best understood as profoundly integral to his view of discourse, which seeks to understand "how particular knowledge systems convince people about what exists in the world (meanings) and determine what they say (attitudes) and do (practices)" (Waitt, 2010, p. 218). These knowledge systems, or "regimes of truth," function as historically and socially contingent devices which determine what is considered "true" at a given time and place, and shape resultant practices accordingly (Foucault, 1977).

Operationally, the environmentality framework first outlined by Agrawal (2005) would be greatly strengthened by explicitly considering the discursive regimes within which overlapping environmentalities exist, and how these shape differentially situated environmental

practices. Foucault writes, "It can be said that this relationship between different elements" – such as individuals, texts, institutions, technologies of government such as classification systems, and the relative positions of subjects within these networks – "is effected by…discourse: it is this, as a practice, that establishes between them all a system of relations that is not 'really' given or constituted *a priori*" (1972, pp. 53-4). If we consider the components of Agrawal's framework – politics, institutions, knowledge, and subjects – discourse facilitates communication, circulation, and co-production between them. From this perspective, environmental subject formation and the environmental practices they facilitate are strongly mediated by the role of discourse: it is the medium through which representations of knowledge and politics are produced and circulated, with institutions as key facilitators of these processes. Thus, analyzing the ways in which environmentalities are constructed and maintained necessitates careful attention to the regime(s) of truth which facilitate such cycles.

To date, the nascent body of environmentality literature has engaged to some degree with Foucauldian discourse analysis, but rarely to my knowledge has it been a central part of their discussion. However, some exceptions emerge. For instance, Orihuela's analysis examines how a particular power/knowledge formation produces "a 'social body' that values scientific reason as guidance for the art of government" (p. 54). The hegemonic national truth regime that results, Orihuela argues, "portrays Amazonian indigenous peoples as savages and an obstacle to national progress" in order to further Peruvian state economic development (ibid.). In another example, O'Riordan et al. (2019) examines how a dominant power-knowledge configuration shapes a discursive coalition among key professional stakeholders who support a "one-size-fits-all," sovereign-neoliberal approach to peatlands conservation (p. 188). In so doing, the authors argue that the state is able to "steer collaborative governance towards contradictory outcomes" and

thereby undermine local governance efforts (ibid.). However, such examples are the exception rather than the norm.

My final suggestion emerges from the need to more fully examine and conceptualize the role of knowledge politics in the (re)production of environmental subjects. As both a key site of negotiation within the politics of competing environmentalities, as well as a primary form of discursive representation generated and circulated by institutional actors, knowledge requires a thorough analysis within Agrawal's environmentality framework. In the next section, I bring Science and Technology Studies into conversation with the environmentality framework in order to strengthen my dissertation analysis.

2.4 Science and technology studies

To more fully theorize the relationship between discursive regimes, environmental practice, and institutions which shape environmental subjects in the context of shale gas development, I turn to science and technology studies, or STS. Broadly, STS is the study of the politics of knowledge, in which "what counts as valid understandings of the environment shapes contestations and outcomes" within environmental and political projects (Goldman & Turner, 2011, p. 2). Whose knowledge "counts" – in other words, who is considered an "expert" – is a fundamental source of critical engagement for STS scholars seeking to illuminate how knowledge is generated, communicated, and used, and in turn how knowledge shapes and is shaped by historically and contextually specific social and power relations. I wish to focus here on *boundary-work*, *boundary objects*, and *co-production* as three important concepts from the STS literature which enable a fuller theorization of knowledge as a key site of discursive representation within an environmentality framework.

A major theme of STS work has centered on critically examining how scientific knowledge has historically been privileged and demarcated from other forms of knowing. Such *boundary-work* (Gieryn, 1983) separates "science" from "non-science," thereby justifying claims to expertise, authority, and legitimacy while limiting access to various professional resources and attainments. Boundary-work both relies upon and reifies the epistemic authority of science as a privileged form of knowledge: acts of boundary-work map the contours of science as a "cultural space," then use those boundaries to expand authority, expel rivals, and protect resources (Gieryn, 1999). Thus, as Gieryn (1983) notes, "The boundaries of science are ambiguous, flexible, historically changing, contextually variable, internally inconsistent, and sometimes disputed" (p. 792). As a result, active points of negotiation between science/non-science and truth/falsehood form key sites where knowledge politics are enacted.

From an environmentality perspective, a significant aspect of producing environmental subjects consists of getting actors to "buy into" the social order projected through a particular governmental rationality. In short, different stakeholders and institutions seek to convince potential environmental subjects of what is "true" and thereby shape the resulting environmental conduct and practice to align with their goals. As a result, sites of knowledge politics – or the contestations and negotiations that occur as different actors and groups seek to legitimize their knowledges and worldviews – also become significant locations where broader environmentality politics are enacted. In other words, boundary-work occurs at the interface between competing environmentalities which attempt to interpellate environmental subjects to perform contradictory goals – such as, for example, supporting or opposing regional shale gas development.

It is important to note that the knowledge politics of such controversies as the shale gas debate do occur within a particular discursive regime, which relies upon certain epistemological

and ontological assumptions about what is knowable – namely, that there is a single "truth" amenable to rational scientific discovery (Merchant, 1980). The premise of a universal truth therefore lays the foundation for contested claims made on its behalf. However, this shared discursive regime also facilitates the production and circulation of *boundary objects* which can transgress boundaries between heterogeneous – or even opposing – claims, groups, and disciplines. In their original formulation, Star and Griesemer (1989) describe boundary objects as

> those scientific objects which both inhabit several intersecting social worlds…*and* satisfy the informational requirements of each of them. Boundary objects are objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. (p. 393)

The authors cite examples such as maps, categorization systems, and specimen collections: each of these objects encompasses "interpretive flexibility," meaning that different groups can use the same object in different ways. In this manner, "boundary objects are a sort of arrangement that allow different groups to work together without consensus" (Star, 2010, p. 602). Thus, even groups making divergent claims can deploy and rely upon the same boundary object.

Crucially, boundary objects function as "representational technologies" and artifacts of knowledge (Ward, 2013, p. 92) – in other words, as a form of discursive text through which knowledge is represented, circulated, and applied. In this way, boundary objects "like maps and texts" help to facilitate translation between "social actors with heterogeneous interests and backgrounds" by "represent[ing] the contested terrain that is the target of collaborative work in formats that have concrete meaning in multiple social worlds" (p. 99). Through an environmentality analytic, boundary objects thus function as one means of circulating representations of knowledge between and across diverse environmentalities and the different subjects they are attempting to interpellate.

Integrating STS and environmentality also involves analyzing the *co-production* of knowledge, policies, institutions, and subjectivities. STS views co-production as the process of how society and scientific knowledge continually (re)shape each other. According to Jasanoff (2004), co-production examines how scientific knowledge "both embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions" (Jasanoff 2004, p. 3). In other words, scientific knowledges and other ways of knowing are inherently present within every aspect of social and political life. Furthermore, a co-production analytic acknowledges and examines "how knowledge and visions of social order co-evolve" (Forsyth and Walker, 2014, p. 411). From this perspective, environmentalities do not merely impose a governmental rationality on the world in a top-down fashion, but are simultaneously shaped and informed by the production, use, and politics of knowledge. Forsyth and Walker (2014) further argue, however, that much of the scholarship at the STS/environmentality juncture focuses primarily on the question of where differing stakeholders *disagree*, rather than critically examining "hidden alliances" such as zones of shared knowledge and discourse. The authors note that environmental knowledge "should not be seen simply as the claims and counter-claims of state and social actors, but rather that these interactions involve various elements of agreements…that give authority to an image of the world" (p. 411).

I would argue that close attention to shared boundary objects can help to identify these "hidden alliances," as well as those actors and viewpoints which are excluded from them, by demonstrating how the shared deployment of a knowledge artifact and/or representational technology can redraw boundaries around a shared community of knowledge – even if different stakeholders use or interpret that knowledge in divergent ways. In a study on Paraguayan market-oriented water management governance, Ward (2013) provides a useful model

demonstrating the integration of co-production and boundary object concepts in this way, by showing how standardized bureaucratic forms became a site of both ideological consensus and dispute. Ward concludes that

> governmentalities…do not simply materialize when standardized rule-making models…are introduced. Rather they emerge as individuals engage strategically with and push back against the boundary objects that a) hold these rather vague models together and b) facilitate maneuvers within and around existing and emerging political-economic, institutional, and policy frameworks. (p. 100)

As this excerpt illustrates, boundary objects such as the zoning plans which Ward investigates might be used across diverse groups, but also can become sites of contestation and resistance. Such sites function not only as sites of knowledge politics, but also where the interplay between overlapping environmentalities transpires. It is through these zones of friction between divergent and opposing arts of government that environmentality politics take place, opening up space for governmental rationalities themselves to emerge, shift, and re-align.

2.5 Agro-food studies and the technology treadmill

Where the previous two sections have outlined the analytical optics this dissertation uses to examine environmental subjectivity (re)production, I wish to bring them together with agro-food studies scholarship to examine farmer-landowner subjectivities in a more nuanced way. Specifically, this section examines trends in 20th century agrarian transformation to lay the groundwork for later exploring how farmers come to be hailed as agricultural environmental subjects, prior to the introduction and subsequent perturbations of the Marcellus shale gas boom.

During the mid-19th century, changes were arising in U.S. agricultural policy that would deeply reconfigure agricultural production across the country. By the late 1800s, the U.S. was in the midst of widespread westward expansion. The accumulation of land, facilitated by the passage of successive U.S. Homestead Acts, "established a broad geographic basis for American farming" by seizing and redistributing lands from dispossessed indigenous Americans to a

majority white American citizenry (Mortazavi, 2018, p. 625). Simultaneously, new institutions and programs began developing to increase agricultural production and efficiency. The Morrill Land-Grant Act (1862), passed the same year as the first Homestead Act, appropriated federal land to create public agricultural colleges in each state – today known as land grant colleges, or LGCs. Such schools were intended to educate farmers in "scientific agriculture" by producing and disseminating the latest in agricultural research to state residents (Bezilla, 1985).

By the early 20th century, the U.S. began experiencing accelerated and widespread rural and agricultural transformation. Such transformation was largely characterized by the shift from subsistence to commercial agriculture, "compelling the transition from peasant producer to capitalist farmer" in the early- to mid-1900s (Moore, 2010, p. 395). The shift to commercial production was accomplished through the production of an agricultural surplus sold via commodity markets – a surplus made possible through agricultural industrialization and mechanization. For instance, DuPuis (2002) illustrates how the introduction and widespread adoption of pasteurization transformed the U.S. dairy industry from "an industry of small-scale dealers into one of major, large-scale, capital-intensive distributors in the early twentieth century" (p. 82). Institutions such as land grant colleges (LGCs), with their mission of producing and distributing "scientific" agricultural knowledge to farmers, played a significant part in facilitating the change from subsistence to commodity production. In this way, LGCs function as an upstream "center of calculation" (Latour, 1987) where knowledge is produced and gathered to be dispersed "downstream" to farmers. This top-down "technology transfer model" (Trauger et al., 2008) conceptualizes knowledge as universal, and thus able to be standardized, packaged, and distributed as discrete practices and/or technologies for farmers to adopt. As farm efficiency increased through industrialization, on-farm labor was freed to join the industrial workforce: the

percentage of U.S. workforce employed in the agricultural sector decreased from an estimated 72 percent in 1820 to 30.2 percent in 1920 (AP, 1988).

Agriculture has long been viewed as uniquely resistant to capital accumulation, due to biological peculiarities which serve as obstacles to industrial expansion (Kautsky, 1899 [1989]; Watts and Goodman, 1997; Mascarenhas and Busch, 2006). New technological developments have performed a crucial function in removing or reducing biological barriers to accumulation, thereby facilitating the industrialization and subsequent integration of agricultural production into industrial capitalism. For example, Boyd and Watts (1997) examine how technological developments in the broiler industry were essential to "solving" such problems as seasonal production, illness, space requirements, and product heterogeneity, all of which hampered the development of large-scale, industrial chicken production. The post-World War II integration of research and development from "big science" researchers and government subsidies facilitated the emergence of a broiler industrial network to produce a suite of new technological developments, such as year-round confinement (enabled through the discovery of Vitamin D and antibiotics); nutritional advancements and the creation of high performance rations; and a breeding "revolution" resulting in new, faster-growing hybrid cross-breeds.

The introduction of new, capital-intensive technologies such as mechanized tractors and nutritional supplements in the early twentieth century laid the foundation for the agricultural "technological treadmill" (Cochrane, 1958; Levins and Cochrane, 1996). This concept posits that farmers must constantly adopt new technologies to increase their profit margin. Early adopters of technologies temporarily enjoy higher profits, due to their improved production efficiency (e.g. new high-performance rations enabling livestock to put on more weight in a shorter time). However, as additional farmers adopt the technology, production increases and commodity

prices go down, reducing profits. According to Cochrane (1958), "laggards" are eventually forced by decreasing prices to either adopt the new technology (often at increased cost to themselves) or are squeezed out of production, resulting in increased farm consolidation. As a result, farmers must continue to invest in new, increasingly expensive technologies if they wish to remain competitive.

Illustrating the technological treadmill in action, DuPuis (2002) traces how fluid milk – a product highly susceptible to bacterial contamination – was industrialized and commoditized in response to pasteurization in the early twentieth century. This technological catalyst rapidly consolidated the American dairy sector, transforming "an industry of small-scale dealers into one of major, large-scale, capital-intensive distributors" in the early twentieth century (p. 82). This process occurred in conjunction with other technological developments such as homogenization to break up fat cells and ensure the even distribution of fat throughout milk; improved railroad transportation, enabling milk's swift conveyance off-farm to urban markets; and refrigeration, preserving a cold-chain from production to consumption. Pasteurization and its associated suite of industrial technologies changed how fluid milk was produced, transported, and regulated, requiring small farmers to invest in a growing number of increasingly expensive technologies. As production costs have grown higher, the number of small farms have continued to shrink throughout the twentieth century.

Technological developments such as pasteurization or high-performance feed rations act as artifacts of scientific knowledge production, through which certain forms of knowledge and expertise are reified, circulated, and applied. These knowledges and technologies are legitimated due to their movement within privileged networks of knowledge production and circulation such as LGCs and their associated Cooperative Extension (CE) programs (Henke and Gieryn, 2008;

Goldman et al., 2011). Researchers and educators embedded within this knowledge system develop and promote such technologies as temporary fixes for the contradictions of capitalist accumulation. When prices are depressed due to overproduction, new production technologies enable farmers to produce more and faster, giving them a reprieve through an increased profit margin. Yet this system also serves the needs of capital, in that knowledge and technology is itself an input to industrial agricultural production, with farmers as the consumers.

Through the LGC and CE knowledge system, U.S. farmers embedded within the industrial agricultural technological regime are thereby "locked in" to a distinct form of agricultural path dependency. Chhetri et al. (2010) argue that industrial agricultural path dependency results when "a particular technological innovation becomes dominant and self-reinforcing, leading to a situation where it excludes competing and possibly superior alternatives" (p. 895). The authors use examples such as hybrid seeds and synthetic chemical pesticides to demonstrate how farmers are locked into a rigid, inflexible institutional apparatus, and are therefore unable to adapt effectively to climate variability and extreme weather. They connect this form of path dependency explicitly to the privileged LGC/CE knowledge network, arguing that industrial agricultural path dependency is "the cumulative outcome of technological trajectories adopted by farmers and promoted by extension services, agricultural policies, and agricultural research systems" (p. 897).

The technology treadmill thesis is not without its flaws. Most notably, numerous researchers argue that the theory, which is situated within the scholarship of neo-classical economics, does little to engage the role of power and how it shapes the production, circulation, and uptake of new knowledge and technology. For example, Busch et al. (1989) note that while the theory explains why farmers adopt new technologies, it does not examine why or how these

innovations are produced in the first place. Similarly, Ward (1993) argues that Cochrane's original conceptualization focuses too much on uptake of technology, rather than the social and political context in which technologies are produced, circulated, and used. Ward notes that political economy frameworks can address these concerns by situating the technology treadmill within the "external pressures" of uneven flows of capital (p. 352).

Ultimately, Ward argues that a revised conceptualization of the technology treadmill "as a set of structural conditions," rather than a linear and causal chain of events, is more useful for understanding how macro-level policies and capital circuits shape the farm-level production (p. 349). This framing is particularly valuable in the context of Kautsky's agrarian question for understanding how technology and scientific knowledge may overcome biological barriers to capital accumulation in the agricultural sector (Mascarenhas and Busch, 2006). Following these developments, several scholars have theorized how to combine or supplement the original agricultural technology treadmill theory with the "treadmill of production" concept, defined as the "tendency within late capitalist society of firms to invest in increasingly capital-intensive systems of production, putting pressure on the underlying natural and social bases of production to extract greater profits" (Diamond, 2013, p. 300; see also Schewe and Stuart 2016). While Cochrane's original conceptualization views the agricultural treadmill as linear, universal, and inevitable, the treadmill of production thesis instead argues that treadmills of production and their effects are frequently uneven and can be resisted, slowed, and stopped. Schewe and Stuart (2014) also note that the original technology treadmill concept assumes farmer homogeneity, and instead argue that individual differences such as debt load or personal values mediate farmers' interactions with new technologies and shape the resulting environmental practices.

Conceptualizing the technology treadmill as a set of contextually contingent structural conditions also allows scholars to investigate treadmill dynamics outside its original settings in post-World War II industrial productionism. Numerous researchers have analyzed technology treadmills within so-called "alternative" – i.e. non-industrial and non-intensive – agricultural production contexts (Hinrichs, 1995; Guthman, 2004; Diamond, 2013; Galt et al., 2016). For example, Hinrichs (1995) examines how some maple syrup producers employ "traditional" and non-mechanized production practices as a way to "differentiate product and add value," creating a reverse treadmill dynamic (p. 46). Machum (2012) notes that, while Cochrane would label farmers who do not adopt new technologies "laggards," the persistence of such practices despite productionist policies and incentives indicates active resistance. Furthermore, even organic, local, fair trade, and other certification schemes intended to resist industrial production remain embedded in an economic system that emphasizes growth. Thus, commodity chains may be shaped by asymmetries of power and influence at different points, continuing to render producers vulnerable to economic competition and thus to treadmill dynamics (Guthman, 2007; Diamond, 2013; Galt et al., 2015). While the original technology treadmill concept has been heavily critiqued, when combined with treadmills of production (Schewe and Stuart, 2014) it can become a valuable framework for understanding how agricultural production operates within late capitalist structural conditions.

In this dissertation, I conceptualize technology treadmill dynamics as a Foucauldian technology of government through which farmer-landowners' conduct is shaped and constrained in certain ways, thereby serving the needs and logics of capital. As a technology of government, treadmill dynamics act on actors embedded in the agro-food sector, creating external economic incentives and conditions which enact certain forms of neoliberal agricultural environmentality.

Furthermore, agricultural production functions as an important site where knowledge politics emerge and are enacted. Industrial agricultural production relies upon certain technologies which can overcome, or at least lessen, biological restraints that historically have limited the production of surplus agricultural commodities. Stakeholders within institutions such as LGCs and their affiliated CE programs are important actors who produce and circulate these knowledge artifacts.

2.6 Conclusion

Together, STS and agro-food studies articulate with an environmentality optics to illustrate how farmer-landowners, LGC researchers, and CE educators are always already formed as agricultural environmental subjects prior to perturbations such as the shale gas boom. This chapter establishes a theoretical framework through which to investigate these dynamics. By combining these analytical approaches, I am able to dissect how study participants are being hailed as divergent environmental subjects, both before and in response to the introduction of shale gas development. This framework has a unique capacity to examine how the multifarious variables identified here – environmental knowledges, policies, institutions, discourses, and subjectivities – are continuously co-produced with and through shifting, contextually contingent environmentalities, with close attention to both structural and individual elements shaping agricultural practices.

At the time of this writing, only a decade has passed since the Marcellus Basin shale gas boom began in earnest. While its long-term effects remain unknown, this analysis seeks to understand how shale gas development is currently disturbing human-environment interactions. I investigate how the process perturbs agricultural landscapes, with farmer-landowners as a key landowner group facilitating the "making" of shale gas resources by leasing their subsurface mineral rights for exploration and extraction. The next chapter provides background information

on shale gas development and the Marcellus region. In particular, I discuss my study area of the Twin Tiers region, where the New York southern tier and Pennsylvania northern tier regulate shale gas development via hydraulic fracturing in opposing ways, thereby opening up a unique and timely opportunity to analyze the impacts of state-level policy through an environmentality lens.

CHAPTER 3

BACKGROUND:

DIVERGENT REGULATORY LANDSCAPES IN THE TWIN TIERS REGION

3.1 Introduction

The rapid rise of shale gas development via hydraulic fracturing, known colloquially as "fracking,"[2] is currently reshaping rural regions of the United States in significant and uneven ways. Farmer-landowners, as a key stakeholder in rural regions, may occupy multiple, overlapping, and/or contradictory orientations towards shale gas development on their agriculturally productive land. Meanwhile, the lack of a comprehensive federal shale gas policy has resulted in a highly heterogenous patchwork of state regulations. As a result, neighboring states of New York and Pennsylvania have adopted opposing shale gas development policies, with each experiencing divergent energy production trajectories. In this dissertation, I examine the Twin Tiers region, situated at the New York/Pennsylvania state border, using agriculture as a lens to understand how shale gas development has reconfigured farmer-landowners' environmental subject positions.

In this chapter, I provide an overview of the context against which the complex interactions occur between knowledge, power, discourse, and environmental subjectivity are being negotiated and (re)shaped. I begin with a description of shale gas development via

[2] The term "fracking" carries with it multiple negative connotations, and is largely used by anti-drilling activists to refer to the entire process of shale gas development (Evensen, 2015). Hydraulic fracturing, from which the term "fracking" originated, is used by the natural gas industry when referring solely to one small piece of the process: namely, the act of flooding well bores under high pressure to release natural gas (see Section 3.2). For the purposes of this dissertation, I will use the phrases "shale gas development" and "unconventional natural gas development" interchangeably when referring to the process of extracting natural gas from the Marcellus Shale formation.

hydraulic fracturing, then review how shale gas development relates to and interacts with agricultural landscapes, outlining agricultural production as a useful and important lens through which to understand hydraulic fracturing. In the third section, I provide an overview of the shale gas regulatory landscape in an effort to address a gap in the literature on shale gas and agriculture, where fairly little research examines policy as a key variable mediating the impacts of shale gas development. Finally, I introduce the Twin Tiers region as a timely and compelling case study, and describe the divergent regulatory approaches of New York and Pennsylvania relative to shale gas development. Together, these sections illustrate how farmer-landowners have come to be shaped as key shale gas gatekeepers in the Marcellus Shale region.

3.2 Hydraulic fracturing: An overview

The U.S. energy landscape looks quite different in the present day than it did even two decades ago. Advances in technologies such as horizontal drilling and hydraulic fracturing have made unconventional energy sources – fossil fuels in non-traditional geologic sources such as shales, coalbeds, and sands – now available for energy exploration and development (Stanford Precourt Institute for Energy, 2019). Until very recently, energy production from such sources has not been considered technologically or economically feasible.

Shale gas development via hydraulic fracturing is a method of natural gas extraction from shale rock formations deep beneath the surface of the earth. The process actually combines two technological innovations: horizontal drilling and hydraulic fracturing. To accomplish horizontal drilling, operators at the well pad drill down vertically a mile or more to the shale deposit. Operators then use an articulable drill bit to drill horizontally through the shale rock formation itself for up to two miles from the well pad. Sometimes, multiple horizontal wells are drilled

from the same well pad. Drilling horizontally greatly increases the likelihood that the well bore will "hit" natural gas (U.S. Department of Energy, 2013).

Hydraulic fracturing occurs in the next stage: after the well bore has been lined with steel casing, explosives are used to puncture holes through the casing into the shale rock. The well bore is then flooded at high pressure with hydro-fracking fluid – a mixture of water, sand, and chemicals – which fractures the shale rock, releasing natural gas trapped within the rock matrix to come to surface. The high volume of water breaks open the shale rock while the sand (or in some cases, ceramic beads or clay) props open the fissures in the shale to increase the flow of gas (EPA, 2018). The chemicals, which account for less than 1% of the hydrofracking fluid by volume, act to increase the water's viscosity and to reduce friction during the hydraulic fracturing process, thereby keeping the well at an appropriate pressure and preventing the well bore and equipment from clogging. Chemicals such as enzymes or oxidizers are later added to decrease the water's viscosity to facilitate its removal (Prud'homme, 2013). Shale gas development requires an average of 1.2 million to 4 million gallons of fluid per well, much of which (though not all) returns to the surface in the form of "flowback" and "produced" water. Flowback is the fluid that emerges from the depressurized wellbore. Produced water is also fluid that emerges from the wellbore, but only once the well has started producing natural gas. Collectively, this is known as "wastewater," and generally contains chemicals from the hydro-fracking fluid, debris from the wellbore, as well as salts, heavy metals, and radioactive elements from the shale formation itself (Prud'homme, 2013; Newton, 2015).

Strictly speaking, hydraulic fracturing itself is not a new technology. Rather, it is the scale at which it is currently being used that is unprecedented. Hydraulic fracturing using nitroglycerin dates back to the 1860s, but it was not until the 1940s that the Stanolind Oil and

Gas Corporation began experimenting with using kerosene, crude oil, and gasoline to fracture gas-bearing formations (Montgomery and Smith, 2010). In 1949, a patent was filed for "Hydraulic fracturing to increase well productivity" (U.S. Patent No. US2664954A, 1949), and the Halliburton Oil Well Cementing Company was granted an exclusive license for its use (Montgomery and Smith, 2010). Beginning in 1981, the Barnett Shale formation in North Texas was the first major shale play to develop in the U.S. (Zuckerman, 2013). Yet it wasn't until the late 1990s that Mitchell Energy CEO George Mitchell's experimentation with novel hydraulic fracturing methods paid off: rather than relying on the lower volume yet cost-prohibitive foam and gel fracturing technologies in use at the time, Mitchell pioneered the high-volume "slick water" method with water, sand, and chemicals that is now widely used (Gertner, 2013). The slick water process proved to be far more economically feasible, reducing the cost of well stimulation by half while greatly improving the amount of recovered gas (Steward, 2008).

Early on, Mitchell Energy predominantly employed vertical drilling in the Barnett Shale formation; however, natural gas drillers began increasingly using horizontal drilling in the early 2000s (Wang and Krupnik, 2013). Other shale plays, such as the Fayetteville Shale in Arkansas and the Haynesville Shale in Louisiana, began developing on the heels of the Barnett Shale's economic success, using the novel combination of hydraulic fracturing and horizontal drilling to open previously inaccessible natural gas sources (Biewick, 2013). This growth was also driven by the increasing price of natural gas from $2 per MBTU[3] in 1999 to $3.85 in 2001, and more than $5 per unit after 2003 (Wang and Krupnik, 2013). Since Mitchell Energy's success with the Barnett Shale, the combination of hydraulic fracturing and horizontal drilling have vastly reshaped the U.S. energy landscape. Between 1996 and 2006, shale gas production tripled to

[3] Million British Thermal Units

account for nearly 6 percent of overall U.S. gas production (Kuuskraa, 2007), and has continued to grow. By 2017, natural gas comprised the largest energy source for U.S. electricity generation at 31.7 percent, compared to 30.1 percent for coal, 20 percent for nuclear, and 17.1 percent for renewables (EIA, 2018).

3.2.1 The Marcellus Shale Boom

Although shale gas development via hydraulic fracturing is currently occurring in multiple locations across the U.S. (Figure 3.1), much of the public attention has been centered on the Marcellus Shale Basin, which is estimated to be the largest domestic reservoir of U.S. natural gas (Engelder and Lash, 2008). The Marcellus Shale formation stretches beneath much of Pennsylvania and West Virginia, as well as southern New York and eastern Ohio (Figure 3.2).

Fairly little public attention was paid to the Marcellus Shale region until January 2008, when a geological report was published finding that the region contained between 168 to 516 trillion cubic feet of natural gas (Engelder and Lash, 2008; Messer, 2008). Of this, 50 trillion cubic feet was estimated to be recoverable thanks to the recent technological developments of hydraulic fracturing and horizontal drilling – more than 25 times the amount originally estimated by the U.S. geological survey (Kubarek, 2017).

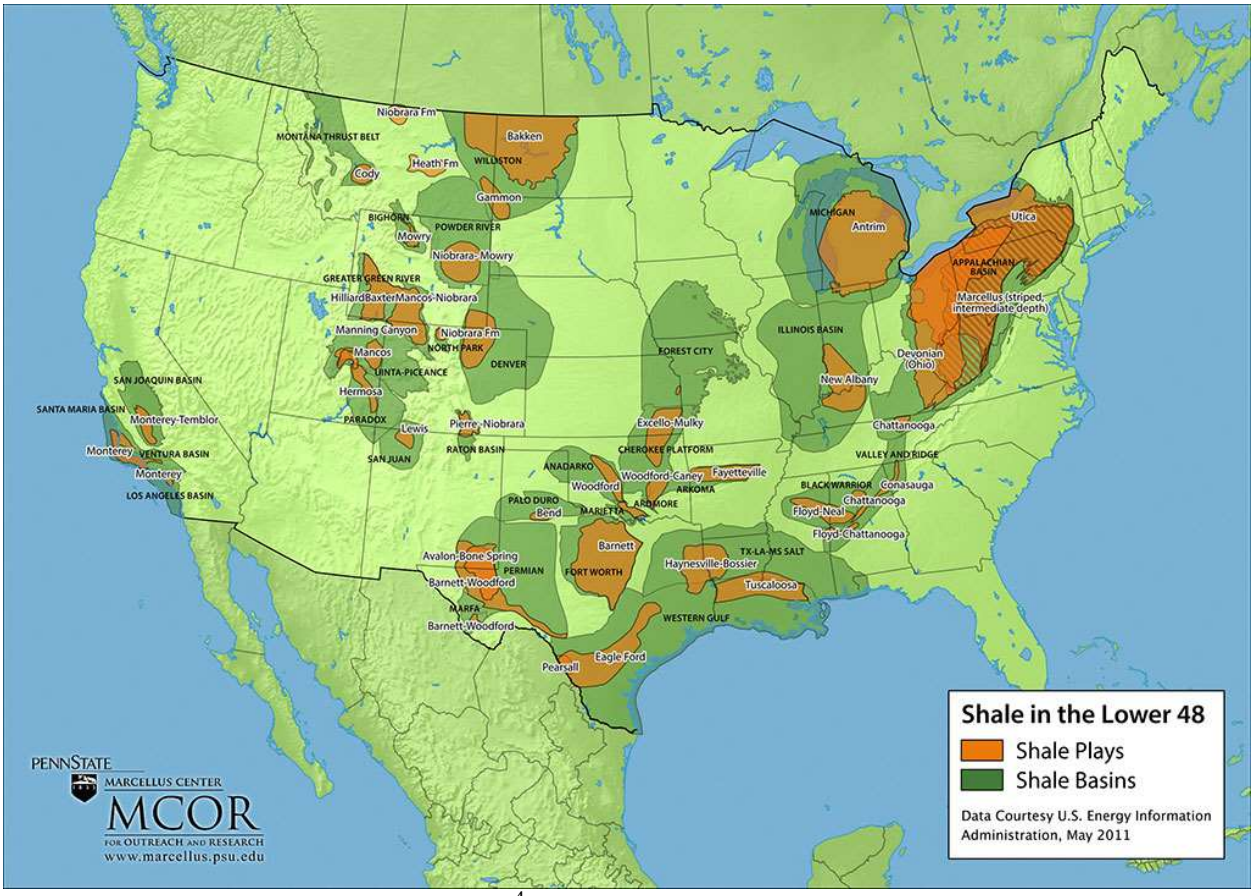

Figure 3.1: Shale basins and shale plays[4] in the continental U.S. (Penn State Marcellus Center for Outreach and Research, 2019a)

[4] Shale basins are subsurface shale rock formations where natural gas is trapped in the rock matrix itself. Shale plays are basins where the trapped shale gas is technologically and economically feasible to extract.

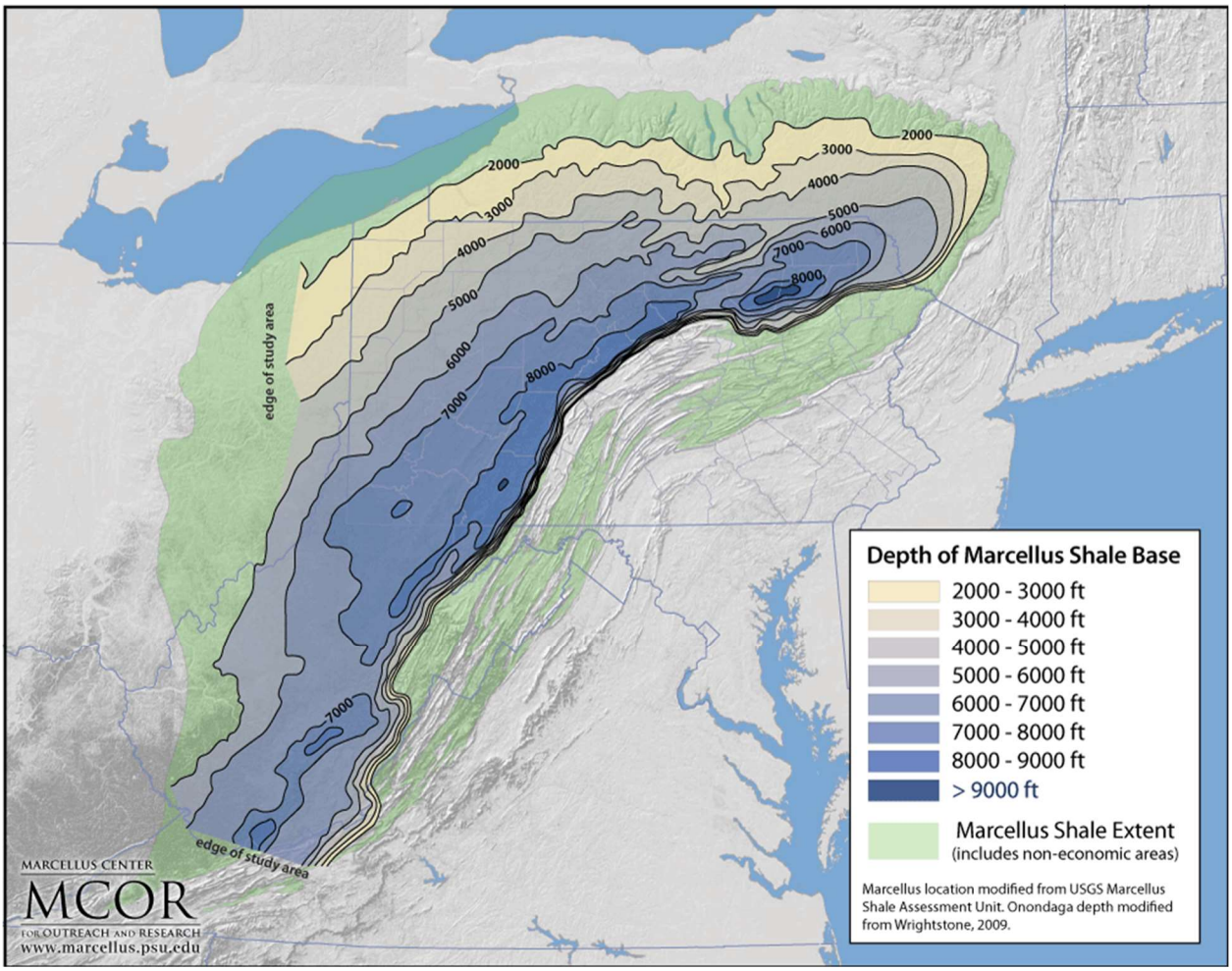

Figure 3.2: Depth of the Marcellus Shale Basin (Penn State Marcellus Center for Outreach and Research, 2019b)

Unconventional drilling had already been underway in the Marcellus Shale region for several years by this point, albeit on a very limited basis. The first permit was granted for an unconventional vertical well in 2001, but the first unconventional horizontal well was not drilled until 2006 (PA DEP, 2019b). By the end of 2007, 45 unconventional horizontal wells had been permitted in the state, 22 of which had been "spudded," meaning drilling operations had started (ibid.). Yet in 2008 alone, permits were issued for 263 unconventional horizontal wells in Pennsylvania (ibid.). A period of aggressive development was soon underway, with over 12,000

permits issued for unconventional wells in the state between 2008 and 2012 (ibid.). By the end of 2018, a total of 11,675 unconventional wells had been drilled in Pennsylvania (PA DEP, 2019a).

Shale gas development is concentrated in the northeastern, or Northern Tier, and southwestern regions of Pennsylvania (Figure 3.3). The top five most-drilled counties in terms of unconventional gas are all located in these two regions, with Washington and Greene in the southwest, and Bradford, Susquehanna, and Tioga in the northeast (Table 3.1). Early in the boom, the majority of shale gas development was occurring in the Northern Tier, with Bradford as the most-drilled county in the state. However, Bradford's production peaked in 2011, and was overtaken by Washington as the most-drilled county in 2015 (Chart 3.4). This is due in part to a difference in the composition of gas between these regions: the northern tier is a "dry gas" region, meaning the shale gas is composed primarily of methane, while the southwestern corner is a "wet gas" region, meaning that hydrocarbons such as ethane, propane, and butane are found in the extracted natural gas (Brockett, 2016). Since the downturn of natural gas prices in 2012, drillers have concentrated more on extracting wet gas, since separating out the hydrocarbons can bring in additional revenue (ibid.).

Table 3.1: Top 10 most-drilled Pennsylvania counties for unconventional gas, 2005-2018

County	Wells Drilled
Washington (SW)	1,810
Susquehanna (NE)	1,606
Bradford (NE)	1,483
Greene (SW)	1,358
Tioga (NE)	1,019
Lycoming (NE)	989
Butler (SW)	600
Fayette (SW)	322
Westmoreland (SW)	321
Wyoming (NE)	280

Source: Pennsylvania Department of Environmental Protection (DEP), 2019

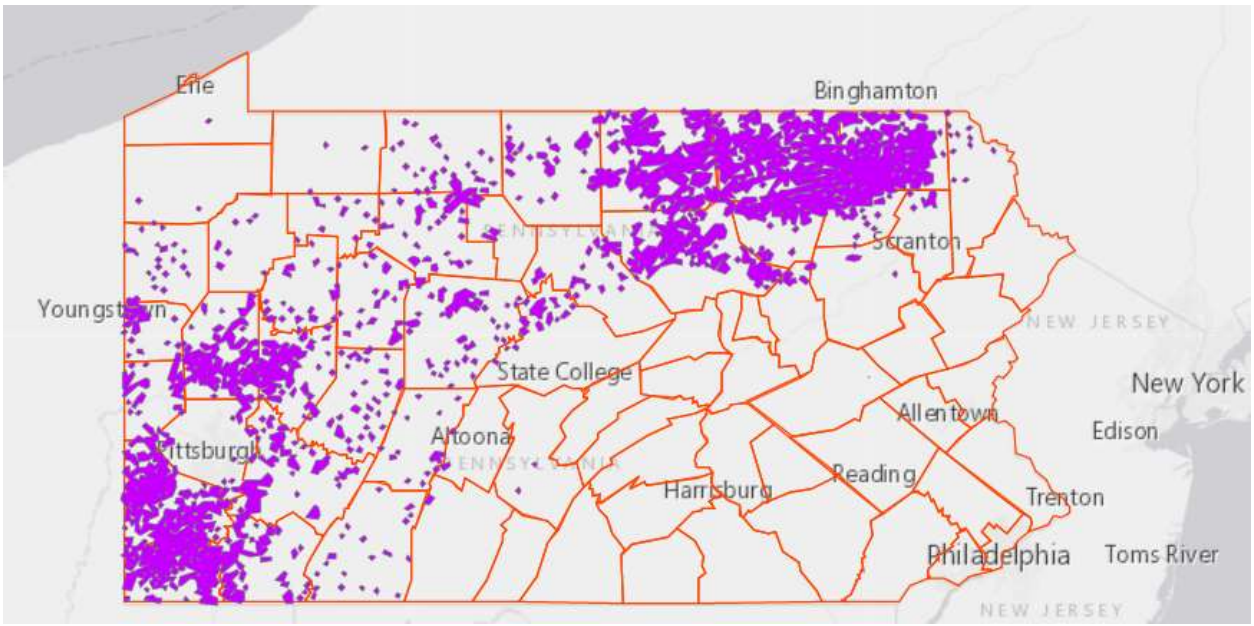

Figure 3.3: Unconventional wells drilled in Pennsylvania, 2000-2018 (FracTracker Alliance PA Shale Viewer, 2019)[5]

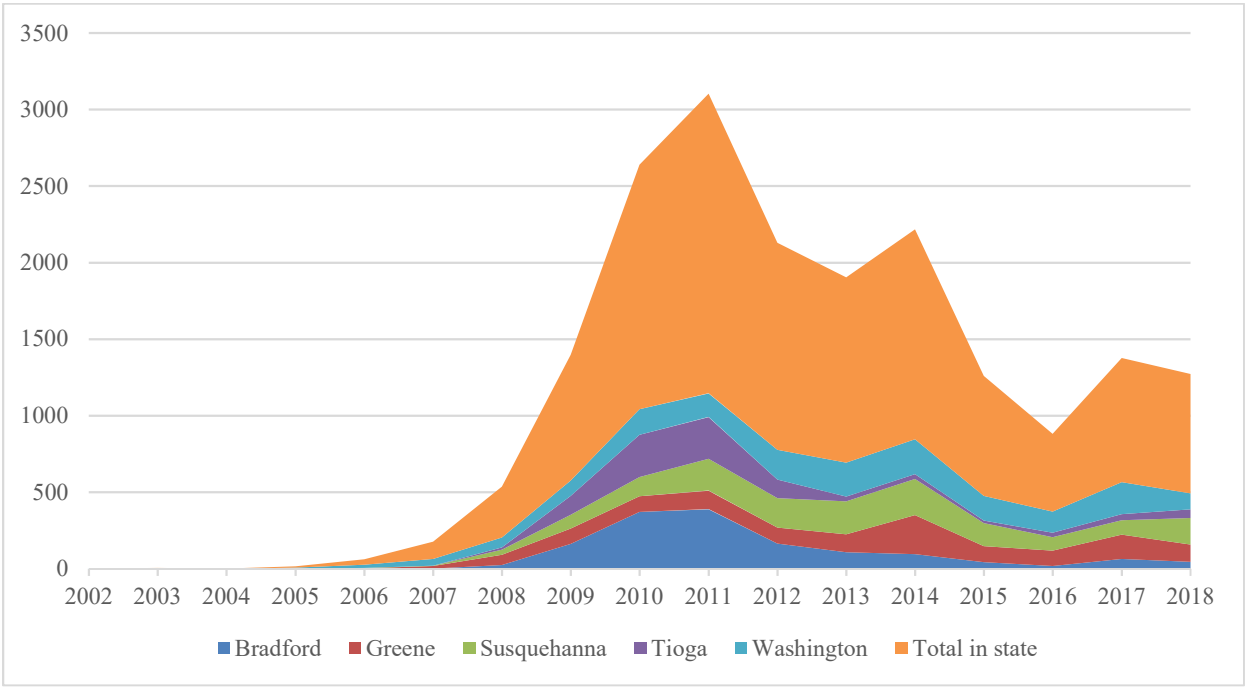

Figure 3.4: Unconventional wells drilled in Pennsylvania by county, 2002-2018 (Pennsylvania Department of Environmental Protection, 2019a)

[5] https://www.fractracker.org/map/us/pennsylvania/pa-shale-viewer/

3.3 Domains of risk and benefit at the shale gas/agriculture intersection

The relationship between shale gas development and agricultural production is dynamic, contradictory, and complex. Vulnerability to the risks, and the ability to capture the benefits, presented by unconventional natural gas development are unevenly distributed spatially and temporally across agricultural landscapes. In this section, I demonstrate how some farmer-landowners in the Marcellus region act as key shale gas "gatekeepers" due to their subsurface mineral rights ownership. As this review will demonstrate, farmers who own their subsurface mineral rights and have larger farms stand to benefit more economically from the shale gas boom. However, these same farmers may feel constrained to lease their land due to structural economic vulnerabilities, and may compete with the oil and gas industry for resources such as land, labor, and infrastructure. Furthermore, smaller-scale farmers using "alternative" methods such as organic or direct-marketing approaches may be more vulnerable to certain risks, such as negative consumer perceptions relating to environmental issues.

Farmers are disproportionately represented as rural landowners in the Marcellus basin, and particularly in the Twin Tiers region where this study is concentrated. According to the USDA (USDA ERS, 2013), farmers in the continental U.S. own or operate over 50 percent of non-urban land. As a result of continuing consolidation trends across the U.S. agricultural landscape, the average farm size in New York is 202 acres, while the average farm in Pennsylvania is 130 acres (USDA, 2014a). In the northern tier region of Pennsylvania, average farm size is even larger: 166 acres in Susquehanna County, 182 acres in Tioga County, and 189 acres in Bradford County (USDA, 2014b). In rural regions such as the Twin Tiers, agriculture is often a – if not *the* – key economic sector of the area (Hoy et al., 2018). Shale gas development via hydraulic fracturing is likewise concentrated in rural regions of the U.S. due to the location of

shale-rich formations, increased space requirements, lower population, and fewer employment opportunities for residents (Weber and Brown, 2013). Multiple studies have found that agricultural land is disproportionately represented in shale gas development-induced land use change, accounting for an estimated 45 to 67% of land cleared for well pads and related infrastructure (Drohan et al., 2012; Jantz et al., 2014; Xiarchos et al., 2017). The large average farm size in rural regions of the Marcellus Basin, as well as the fact that most farmland is generally cleared and contains few (or no) buildings, make farmland an attractive option given the large space requirements for unconventional natural gas development (Jantz et al., 2014). Even after well pads are reclaimed, long-term impacts could persist, including disturbed and compacted soil, erosion due to increases in bare soil, and larger nitrogen and phosphorus loads resulting from erosion, all potentially causing cumulative downstream impacts within the regional watershed (ibid.). As a result, there is large potential for shale gas development to impact farmers' businesses and day-to-day lives, for better or for worse.

Shale gas development has only been happening in the Marcellus region for a decade. To date, fairly little research has looked explicitly at the relationship between agricultural production and unconventional natural gas. Some studies have examined domains where agriculture and shale gas production could feasibly intersect, such as water quality and quantity concerns; competition over inputs like land, labor, and infrastructure; impacts on farmers' businesses and wealth; and community wellbeing (Hitaj et al., 2014). Yet given the recent nature of the shale boom, long-term implications across these domains remain unclear. Additionally, differences between regions and states, as well as the type of farming activity, mean that some farmers may experience more or different consequences. For example, arid regions in the Western U.S. are more likely to experience water quantity pressures than the more humid

northeastern U.S. (Healy, 2012). Furthermore, in early 2014 North Dakota grain farmers who rely on rail transportation lost an estimated $66.6 million in revenue due to competition for rail shipment and resulting delays (Olson, 2014). Additionally, dairy or livestock farmers may be more sensitive to air and water quality issues (Bamberger and Oswald, 2012; Gibson, 2013). Some studies have found decreases in total milk production and herd size in Pennsylvania counties where unconventional drilling occurs (Adams and Kelsey, 2012; Finkel et al., 2013; Brasier et al., 2017). Yet in each of these three studies, the authors stress that the findings only denote a correlation, and are unable to explain whether the changes are due to farmers retiring, shifting to other forms of agricultural production such as beef or grain, or exiting farming altogether as a result of royalty and signing bonus payments.[6]

The question of economic benefits to farmers, accruing from leasing their subsurface mineral rights for drilling, is a key issue in the shale gas debate. A common refrain in the popular media is that shale gas development can "save family farms" by helping farmers pay off debts, update their equipment, and save for retirement (Sneegas, 2016). This claim is borne out by scholarly research: one study found that Pennsylvania farmers received an average royalty payment of $154,000 in 2014, compared to a national average of $56,000 (Hitaj and Suttles, 2016). Furthermore, the authors also found that royalty payments were strongly mediated by farm size, with small farms earning about $45 per acre, medium-sized farms receiving $98 per acre, and large farms earning $110 per acre.

However, economic benefits are not evenly distributed among farmer-landowners. The main variable explaining whether or not farmers will benefit economically from shale gas development is whether they own mineral rights. Studies find that farmers in new drilling

[6] These numbers could also be impacted by national milk prices, which decreased sharply during the same period (Glenna et al., 2013).

regions are more likely to retain subsurface mineral rights; for instance, local mineral rights ownership is twice as common in Pennsylvania as Texas (Fitzgerald, 2014; Hitaj and Suttles, 2016; Malin and DeMaster, 2016). Furthermore, the federal government included mineral rights with homestead claims prior to 1908. After 1916, however, the federal government began reserving subsurface mineral rights from homestead claims, creating "split estates". Today, an estimated forty percent of federal split estates are in Montana and Wyoming; including Colorado, New Mexico, and North Dakota brings that total to nearly 75 percent (Fitzgerald, 2014). Thus, farmer-landowners in the Marcellus region – particularly those whose land tenure dates back multiple generations – are likely to be in a position to accrue natural gas royalty income.

Some research highlights that economic impacts from shale gas development are not uniformly positive. For instance, while farms which directly use natural gas benefit from decreased gas prices, fertilizer prices have not decreased, even though natural gas is a major input for creating nitrogen fertilizer (Pirog and Ratner, 2012). The effect of unconventional natural gas development on farmland real estate value is also unclear. Some studies find positive impacts in the short-term, with increases in land purchase and value occurring during periods of leasing and drilling (Weber, Brown, and Pender, 2013; Weber and Hitaj, 2015; Thakor, 2015). However, Weber, Brown and Pender (2013) note that if local amenity deterioration persists or worsens, this could drive land values down. The temporal dimensions of resource booms are also a key component, in that unconventional wells produce a great deal in their first year, then decline rapidly. Thus, it is uncertain how boom-bust dynamics will impact the agricultural economy in years to come (Brasier et al., 2014). Furthermore, Weber and Hitaj (2015) find that land value appreciation is not uniformly positive: they argue that livestock farms experience

lower or negative gains, and that increases in value appear to be greater in regions where landowners are more likely to retain subsurface mineral rights.

One longitudinal study (Glenna et al., 2014; Brasier et al., 2014; Brasier et al., 2017) has sought to identify some of the longer-term effects of shale gas development across multiple social and economic domains in Pennsylvania, and identified conflicting economic impacts for farms in the state. The researchers find increases in overall lease and royalty outcome, which has "downstream" effects for regional agribusiness as farmers updated farm equipment, and also note growth in the number and size of farms in the northern tier. However, there were impacts to the use of resources such as farmland and groundwater, farm and agribusiness labor availability, soil and water quality, and road accessibility issues. Focus groups found that farmers perceived positive economic benefits, but had negative perceptions of the gas industry and conflicting ideas of what unconventional gas drilling meant for the environment and overall quality of life. Additional studies measuring the economic impacts of shale gas development on the agricultural sector in the Marcellus Region have also found a contradictory mix of positive and negative economic effects (Xiarchos et al., 2017; Hoy et al., 2018).

A further domain of study at the intersection of agriculture and shale gas development relates to questions of disempowerment and environmental (in)justice. Perry (2011, 2012) argues that the rapid development associated with the shale gas boom in Pennsylvania's northern tier leads to a sense of "collective trauma" in the community. Perry situates the shale gas boom within the region's long-term economic decline, noting that there were strong pressures, and even bullying, within farmers' peer groups to sign drilling leases and support development for financial reasons. Perry also finds that many small- and mid-sized livestock farmers felt misled by drilling companies about both prospective financial gains and the impacts to their land,

although Malin (2014) argues that many small-scale farmers come to normalize shale gas development and its impacts over time. However, Malin aligns with Perry by viewing farmers' agency as limited due to systemic, structural vulnerabilities, such as debt, limited and/or volatile agricultural markets, and reliance on government subsidies. Malin and DeMaster (2016) further argue that small and mid-sized farmers in the region are privy to greater environmental risks due to lack of access to information, and are "constrained" to sign leases due to financial precarity. This, the authors argue, result in "rural environmental injustice" whereby farmers and other rural residents are exposed to greater environmental risk.

However, these studies look primarily at small and mid-sized family farms in Pennsylvania's northern tier, and do not include large-scale farms in their analysis. This opens up the question of whether and how the impacts of shale gas development might be differentially experienced across diverse farm sizes and modes of agricultural production, distribution, and marketing. In particular, a persistent concern circulated in the popular media relates to the potential for shale gas development to negatively impact sustainable food production, causing organic farmers in the region to lose their accreditation and injuring local and sustainable food production efforts (Food and Water Watch, 2012; Hitaj et al., 2014; Auch, Henao, and Malone, 2015). For instance, in 2010 the Brooklyn-based Park Slope Food Coop published a statement stating that, if hydraulic fracturing were to be permitted in New York state, they would be forced to purchase food outside the state:[7]

> [W]e have taken our responsibility to buy New York State produced food very seriously. But no one thinking clearly would think for a minute that hydrofracking will not quickly destroy that commitment… Please insure [sic] that we are not wondering about whether the grass fed cows we buy were drinking contaminated water and breathing the air fouled by numerous enormous trucks that will support the hydrofracking process and the process

[7] Park Slope Coop estimates that in 2009, they purchased $2.4 million of meats, dairy, fruits and vegetables produced in New York State.

> itself. I guarantee that our members will not want the fruits and veggies that come from farms in an industrial area. (Holtz, 2010).

Despite the persistence of these and similar fears in the popular media, Hoy et al. (2018) do not find that shale gas development has negatively impacted the organic agriculture sector in the Marcellus region: the authors note, "Both the number of organic farms and the market value of organic sales are increasing over time, but there is no significant effect of drilling on either outcome" (p. 17). There does, however, appear to be a significant difference in how "sustainable" and "conventional" farmers perceive the impacts of shale gas development.[8] Poulson et al. (2018) find that conventional farmers are more likely to support shale gas development in the Marcellus region, and that this support was strongly mediated by receiving lease and royalty income from shale gas drilling. They also found that sustainable farmers face unique impacts relating to shale gas extraction on or near their land, including "greater sensitivity to environmental impacts, risks to organic certification and market participation, declining consumer confidence, and depreciating value" of their farm operations (p. 24). Outside of these examples, I have found no other studies which explicitly compare the impacts of shale gas development between conventional and alternative agriculture.[9]

As Braiser et al. (2017) summarize, "[unconventional natural gas development] impacts vary by social group, by geographic location, by point in time, and by the type of impact that is of interest" (p. iv). The same is true for the impacts of shale gas development on the agricultural sector. As this section illustrates, the relationship between shale gas development and agricultural production is shifting and complex, with costs and benefits distributed unevenly

[8] Poulson et al. (2018) define "sustainable" farmers as exhibiting certain characteristics, which include "the prioritization of local and regional production, valorization of nature and avoidance of agricultural chemicals, a focus on community and rural culture, and emphasis on restraint and consideration of external costs" (p. 25).
[9] However, the majority of ethnographic research I have found (Perry 2011, 2012; Malin, 2014; Malin and DeMaster, 2016) does focus primarily on smaller-scale production, which is often conflated with organic, sustainable, direct-market, and other "alternative" production methods.

across agricultural landscapes. While the available scholarly literature illustrates that these benefits and risks are unequally allocated along lines of farm size and production methods, fairly little research to date looks at the role of policy and regulation as a key variable mediating the impacts of shale gas development. In this dissertation, I seek to understand the relationship between agriculture and shale gas against the backdrop of divergent oil and gas regulations which can play a key role in the formation of certain types of environmental subject positions, values, and perceptions. In the following sections, I outline the regulatory context in which shale gas development is regulated, beginning with federal unconventional oil and gas policy, then moving to the Twin Tiers region where the dissertation is focused.

3.4 Federal regulatory context: Unconventional natural gas development

At the present time, there is no federal legislation regulating shale gas development at the national scale. Instead, the regulatory environment for shale gas development is accomplished at the state level, resulting in a highly heterogeneous state-by-state regulatory landscape (Brady & Crannell, 2012; Negro, 2012; Richardson et al., 2013; Warner & Shapiro, 2013; Davis, 2014; Mortazavi, 2018). In this section, I provide an overview of key legislation shaping current shale gas development policy at the federal level.

Several federal policies exist that, in theory, should regulate shale gas development via hydraulic fracturing. Yet in practice, numerous exemptions exist within each, resulting in an overall lack of comprehensive federal legislation relating to unconventional natural gas development. Table 3.2 provides an overview of these major federal environmental policies, while the following section gives a more in-depth illustration of how hydraulic fracturing came to be exempted from the Safe Water Drinking Act, and by extension from all major federal environmental regulation. I then summarize the most recent federal attempt to regulate

unconventional natural gas development via hydraulic fracturing through the Bureau of Land Management, and the current state of that policy.

3.4.1 Safe Drinking Water Act

The Safe Drinking Water Act (SDWA) was passed in 1974 to ensure clean public water supplies in the U.S.; implementation of SDWA falls to the Environmental Protection Agency (EPA, 2015b). Under SDWA, the Environmental Protection Agency (EPA) is tasked with protecting U.S. drinking water resources, both current and future (Safe Water Drinking Act, 1974). The EPA protects groundwater through the Underground Injection Control (UIC) program, which seeks to protect subsurface water reserves from injected fluids, including those related to oil and gas development and waste disposal (EPA, 2004). Under the UIC program, the EPA sets minimum requirements for individual states; each state must then submit a proposed Underground Injection Control program to the EPA for approval (LEAF v EPA, 1997). Under the SDWA, there are six classes of underground injection wells, with Class I wells (containing hazardous waste) subject to the strictest standards (Table 3.3).[10]

[10] The sixth well classification was not finalized until 2016. https://www.epa.gov/uic/final-class-vi-guidance-documents

Table 3.2: Federal regulations and exemptions for hydraulic fracturing in the United States

Federal Regulation	Scope of Regulation	Exemptions
Safe Water Drinking Act	Ensures clean public water supplies Regulates of subsurface fluid injection	Hydraulic fracturing wells exempted from Class I well restrictions No federal disclosure requirement for hydraulic fracturing fluid chemical types/concentrations
Clean Water Act	Regulates pollutants discharged into U.S. waters	Oil field and gas operations exempted from stormwater runoff permit requirements
Clean Air Act	Regulates air emissions Authorizes emission standards for hazardous air pollutants	Oil and natural gas emissions from exploration/production wells exempt Permits for hazardous air pollutants not required
Resource Conservation and Recovery Act	Regulates handling, treatment, storage and disposal of hazardous waste	Exemption for oil field wastes, including hydraulic fracturing wastewater, from classification as hazardous waste
National Environmental Policy Act	Requires Environmental Assessments for government agencies to consider potential environmental impacts of legislation	Exemption for all activities relating to exploration and production of natural gas
Emergency Planning and Right-to-Know Act	Requires collection and release of data on chemicals used by industry near communities	Oil and gas industries not required to disclose chemical information
Comprehensive Environmental Response, Compensation, and Liability Act	Funds cleanup and remediation of accidents, spills, and abandoned or orphaned hazardous waste sites	Oil fields and spills involving natural gas, oil, or crude petroleum not defined as hazardous waste and exempted from regulation

Source: Kosnik, 2007; Brady & Crannell, 2012; Mortazavi, 2018; Table reproduced from Sneegas, 2016

Table 3.3: EPA underground injection well classifications

Classification	Description of injected fluids
Class I wells	Disposal wells for hazardous, industrial, and/or municipal waste injected underneath underground drinking water sources in deep rock formations
Class II wells	1) Fluids brought to Earth's surface used in conventional oil/natural gas production 2) Fluids used to enhance recovery of oil/natural gas 3) Fluids used to store hydrocarbons
Class III wells	Fluids injected to dissolve and extract minerals
Class IV wells	Disposal wells for hazardous or radioactive waste into or above geologic formations containing subsurface drinking water sources
Class V wells	Injection wells not included in the other four classifications
Class VI wells	Wells injecting carbon dioxide into subsurface geologic formations (carbon sequestration)

Source: LEAF I (footnote 2); EPA, 2018: https://www.epa.gov/uic/underground-injection-control-well-classes

In March 1994, the Legal Environmental Assistance Foundation, or LEAF, petitioned EPA to withdraw its approval of the Alabama Underground Injection Control program, arguing that it did not adequately regulate hydraulic fracturing which was being used to extract methane from coal beds (LEAF v EPA, 1997). Previously both the State Oil and Gas Board of Alabama and the Alabama Department of Environmental Management had asserted that hydraulic fracturing was not considered underground "emplacement" since it was not permanent (ibid.). The EPA denied LEAF's petition in 1995, on the grounds that the regulatory definition of "underground injection" did not encompass the hydraulic fracturing process. The EPA argued instead that the UIC program was intended to regulate wells whose "principal function" is underground fluid injection, with the principal function of hydraulic fracturing being methane gas production (ibid.). Following the EPA's denial, LEAF brought a petition for review of the EPA decision to the United State Court of Appeals for the Eleventh Circuit. In 1997, the Eleventh Circuit ruled that hydraulic fracturing does constitute "underground injection" and is therefore subject to regulation under the Safe Water Drinking Act (ibid.).

The EPA first planned to regulate hydraulic fracturing as a Class II well, since that classification includes injection wells "for enhanced recovery of oil or natural gas" (65 Fed. Reg., 2891-92; LEAF v EPA 2001). However, the EPA ultimately defined hydraulic fracturing as a "Class II-like underground activity" on the grounds that "the injection of fracture fluids through these wells is often a one-time exercise of extremely limited duration," generally taking two hours or less (LEAF v EPA, 2001). This categorization, the EPA argued, would allow "Alabama the flexibility to fashion an appropriate regulatory program addressing hydraulic fracturing which need not mirror all existing requirements…for Class II wells" (65 Fed. Reg., 2891-92; LEAF v EPA, 2001). Although the EPA began proceedings to withdraw approval for

Alabama's UIC program, the state submitted a revised program in 1999 which the EPA subsequently approved (LEAF v EPA, 2001; 64 Fed. Reg. 56986 (1999)). The final rule was published in 2000 despite objections from LEAF (§ 1425. See 65 Fed. Reg. 2889 (2000)). As a result, LEAF petitioned the 11th circuit to rescind approval for the Alabama UIC program. Their case rested on two primary arguments: first, they contended that hydro-fracking fluid injection should not be regulated as "secondary or tertiary" natural gas recovery under SWDA, and therefore does not qualify for regulation under SWDA. Second, LEAF claimed that hydro-fracked wells should be regulated as Class II wells, as opposed to "Class II-like underground activity."

In their final decision, the 11th circuit sided with the EPA on its interpretation of hydraulic fracturing as "analogous" to secondary or tertiary oil and gas recovery. However, the court sided with LEAF on its contention that the EPA's classification of hydro-fracked wells as "Class II-like" was contrary to the law, because it did not abide by the "plain language" of existing regulatory classifications: "Where the classification system sets forth five classes, one of which serves as a catch-all for any well not covered by the first four, EPA must classify hydraulic fracturing into one of those categories" (LEAF v EPA, 2001). As a result, the EPA was ordered to reconsider Alabama's revised UIC proposal under the SWDA Class II well requirements.

While the 1997 and 2001 11th circuit decisions may seem like a win for environmental regulation of shale gas development, they set in motion a process that would eventually result in the exemption of hydraulic fracturing from nearly all major federal environmental policy, including the SWDA. Following the court's final rule, the EPA published a report assessing the potential for groundwater contamination by hydraulically fractured wells into coalbed methane

(EPA, 2004). The study found that the hydraulic fracturing process poses "little to no threat" for subsurface water resources. Subsequently, the report has been frequently cited as evidence that hydraulic fracturing is not responsible for groundwater contamination (Lustgarden, 2008). However, the report only examines the relationship between hydraulic fracturing and groundwater in *coal bed methane*, or relatively shallow coal strata of approximately 200-1000 meters deep where methane gas is trapped within the coal rock matrix (Rajput and Thakur, 2016). The report did not examine hydraulic fracturing in the context of deep geologic formations such as shale gas, which in the Marcellus formation ranges from 600-2700 meters deep (Lustgarden, 2008; Penn State Marcellus Center for Outreach and Research, 2019b). Furthermore, former EPA employee and scientist Weston Wilson sent a letter to Congress under the Whistleblower Protection Act, stating that "EPA has conducted limited research researching the unsupported conclusion that this industry practice needs no further study." In his letter, Wilson also noted that five members of the study's peer review panel had conflicts-of-interest and could materially benefit from lessened regulations on hydraulic fracturing (Wilson, 2004).

Despite Wilson's contentions, the Energy Policy Act of 2005 used the 2004 EPA study to justify amending the SDWA, in what has come to be called the "Halliburton Loophole."[11] Acting on a recommendation made by the Energy Task Force (National Energy Policy Development Group, 2001), which was headed by then-Vice President Dick Cheney, the 2005 Energy Policy Act added two exemptions to the bill's definition of "underground injection": "(i) the underground injection of natural gas for purposes of storage, and (ii) the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas or geothermal production activities" (section 322: Hydraulic Fracturing). By

[11] So titled due to Vice President Dick Cheyney's ties to Halliburton, where he was CEO from 1995-2000 (Hamburger and Miller, 2004).

changing the definition of "underground injection," this amendment rendered the 11th circuit court's decision in LEAF v EPA (1997) invalid: hydraulic fracturing would no longer be regulated under the SWDA. As a result, the natural gas industry is also not required to disclose the types and concentrations of chemicals used in hydraulic fracturing fluids (Phillips, 2011). Currently, only wastewater produced from fracking is regulated by SDWA according to Class II injection well standards (SWDA, 2015 [1974]; Brady & Crannell, 2012).

3.4.2 Bureau of Land Management – 43 CFR Part 3160

On March 20, 2015, the Obama administration announced new federal legislation designed to regulate hydraulic fracturing on federal lands (Davenport, 2015). The key components of the final rule included provisions to protect groundwater through well integrity validation and standards; chemical disclosure requirements; wastewater storage standards; and measures designed to lower risk of contamination between hydraulic fracturing wells. A Bureau of Land Management (BLM) press release for the final rule described the policy as containing "commonsense standards" to "support safe, responsible hydraulic fracturing" on BLM and tribal land (Kershaw, 2015). These provisions included the use of the industry-run FracFocus website for chemical disclosures; looser restrictions on chemical disclosures to allow "trade secrets" to be withheld more easily; and the exemption of "well stimulation" techniques other than hydraulic fracturing – provisions which strongly resemble model legislation drafted by the American Legislative Exchange Council, a group that promotes "business-friendly" legislation (Currier, 2012). Further, the BLM final rule only applied to public and tribal lands.

Despite these concessions, the policy was widely criticized by conservative politicians and natural gas industry representatives (The Associated Press, 2015; Ritenbaugh, 2015). Two months after the final rule was published, the states of Wyoming and Colorado, as well as the

Western Energy Alliance and the Independent Petroleum Association of America, sued BLM on the grounds that it oversteps the BLM's regulatory authority (Wyoming v. U.S. Dep't of the Interior, No. 2:15-cv-00043). The Ute Indian Tribe, later added as an additional petitioner, also argued that the BLM rule conflicted with federal obligations towards their tribe and infringed upon tribal sovereignty. In June 2016, the District of Wyoming struck down the BLM rule, interpreting the exclusion of hydraulic fracturing from the Safe Drinking Water Act (Energy Policy Act, 2005; see section 2.4.1) as evidence that hydraulic fracturing is subject to no federal agency oversight.

BLM appealed the District of Wyoming's decision in the 10th Circuit of Appeals. Oral arguments, originally scheduled for January 2017, were delayed until the following March after Donald Trump's inauguration as President (Environmental & Energy Law Program, 2017). On Marcy 28, 2017, President Trump issued an executive order (13783) titled "Promoting Energy Independence and Economic Growth" which directed federal agencies to "review existing regulations that potentially burden the development or use of domestically and produced energy resources and appropriately suspend, revise, or rescind those that unduly burden the development of domestic energy resources." The executive order specifically directed the Secretary of the Interior, Ryan Zinke, to review the BLM final rule on hydraulic fracturing. The following day, Zinke issued a secretarial order, titled "American Energy Independence," to the BLM in order to begin rescinding the final rule (82 FR 34464). As a result, the 10th Circuit dismissed the lawsuit in September 2017 (Environmental & Energy Law Program, 2017), and the BLM rule was formally voided in December 2017.[12]

[12] Although the 2015 BLM rule never took effect because of the ongoing litigation, the formal rescission of the rule by the Trump Administration does not mean legal challenges are over. California State and an environmental group coalition are currently suing BLM over the rescinded rule (Environmental Law at Harvard, 2018).

3.5 Study Area: The Twin Tiers Region

Due to the lack of comprehensive federal policy, unconventional natural gas development via hydraulic fracturing is regulated at the state level. As a result, state-by-state policies can vary widely in how they regulate the process. This is particularly true in the Marcellus Shale Basin, where New York state has banned hydraulic fracturing since December 2014 (Neuhauser, 2014) while in Pennsylvania, more than 11,000 unconventional wells have been drilled since 2005 (PA DEP, 2018b). These divergent regulatory approaches are creating two regions with distinctive patterns of rural transformation and development, as hydraulic fracturing is experienced in uneven ways across the agricultural landscape. To investigate the impacts of hydraulic fracturing on farmers' perspectives and experiences, this project focuses on the Twin Tiers region, a 13-county area at the New York and Pennsylvania border situated within the Marcellus Shale Basin. The two states' divergent approaches to regulating shale gas development via hydraulic fracturing have resulted in a dynamic terrain in which Pennsylvania's northern tier is experiencing rapid and considerable energy development, even as New York's southern tier does not. These conditions outline a compelling case study to empirically examine the ongoing impacts unconventional shale gas development is having within and across agricultural landscapes.

Following pilot research conducted in Summer 2015, I first selected seven counties for analysis in the Twin Tiers region (Figure 3.5). The three Pennsylvania counties (Bradford, Susquehanna, Tioga) are among the five most-drilled counties in the state in terms of unconventional development, collectively accounting for over 4,000 unconventional wells, or approximately 35 percent of the state's total (Table 1; PA DEP 2018b). Bradford County was the county with the most unconventional drilling activity until 2015, when it was overtaken by

Washington County in the southwestern part of the state due to lowering gas prices (T. Murphy, personal communication, July 13, 2015). I selected four New York counties (Broome, Chemung, Steuben, Tioga) located directly across the state border: these counties have experienced little unconventional shale gas development due to a state-wide moratorium, and later formal ban, on hydraulic fracturing first enacted in 2010 (Trotta and Honan, 2010; Neuhauser, 2014).

Over the course of conducting fieldwork in Fall 2017, I added Tompkins and Schuyler Counties in New York for three reasons. First, Cornell University (New York state's land grant college) is located in Tompkins County, so many of my university and Cooperative Extension-affiliated participants were located there. Second, in an effort to include important pro- and anti-drilling activist perspectives, I included some participants outside my originally proposed study area. Finally, adding these two counties allowed me to include perspectives from the prominent Finger Lakes agro-tourism sector. For similar reasons, I included participants from some counties outside those proposed for Pennsylvania, primarily Centre County which is home to the Pennsylvania State University (Table 3.4 for participants by county).

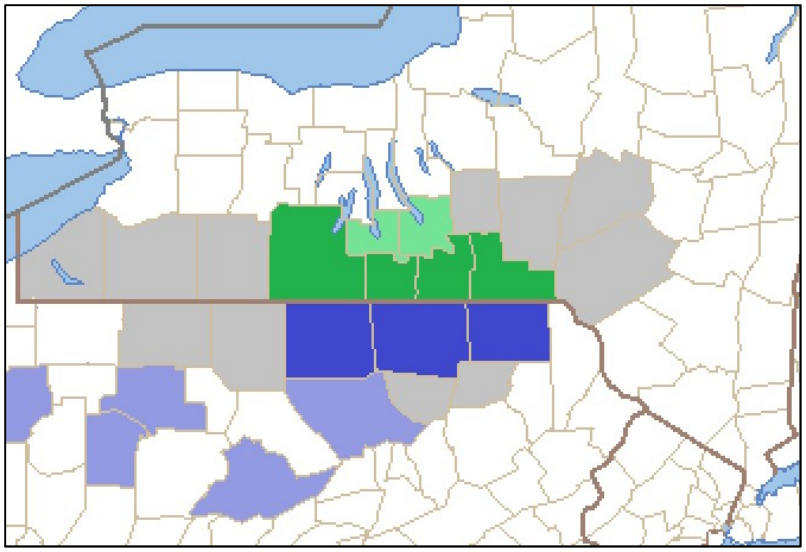

Figure 3.5: Twin Tiers study area
Note: The darker colors indicate the counties originally selected for analysis. The lighter shades include counties where participants were added over the course of fieldwork.

Table 3.4: Study participants by county

County	**Number of participants**
Pennsylvania	*23*
Bradford*	7
Centre	4
Elk	1
Jefferson	1
Lycoming	2
Susquehanna*	3
Tioga*	4
Venango	1
New York	*26*
Broome*	1
Chemung*	1
Schuyler	4
Steuben*	9
Tioga*	2
Tompkins	9

*Denoting counties originally included for analysis

3.5.1 Shared Historic & Economic Context

The Twin Tiers region, consisting of the New York southern tier and the Pennsylvania northern tier, is predominantly rural with a historically strong agricultural sector. The region was characterized by diversified subsistence farming until the late 19th century, then dominated by dairy and fluid milk production until shortly after World War II (PHMC, 2015). Over the latter half of the 20th century the dairy sector weakened, paralleling national agricultural restructuring trends in increased industrialization and consolidation, resulting in fewer but larger farms (Simonelli and Winters, 1987). Dairy continues to be a prominent part of the region's agricultural sector: milk and dairy products comprise 44 percent of the Pennsylvania Northern Tier's agricultural sales, and 45 percent of the New York Southern Tier's agricultural sales (USDA Agricultural Census, 2012a,b). However, the region is by no means considered among the most agriculturally productive part of each state. Northern tier counties account for only 3.4 percent of total state-wide agricultural sales in Pennsylvania, while southern tier counties comprise only 7 percent – a number which drops to 4.9 percent if Schuyler and Tompkins Counties, which border the Finger Lakes and benefit from the region's agro-tourism and winery sales, are excluded (ibid.).

The Twin Tiers region also shares a history of extractive industry, with timber and coal on the Pennsylvania side, and timber and stone mining on the New York side (Bugden, Evensen, and Stedman, 2017). Furthermore, oil and natural gas were both extracted along the state border in the 19th century, although most of the early activity occurred further to the west in each state. For instance, Titusville, Pennsylvania is cited as the site of the first large-scale commercial oil well drilled in the U.S., the discovery of which set off the Pennsylvania Oil Rush in 1859 (EPC, 2018). Additionally, the first commercial shale gas well was drilled in Fredonia, New York in

1825 (Lash and Lash, 2014). Although much of the early oil and gas activity was concentrated in the western portion of both states, the Twin Tiers region also experienced some conventional drilling throughout the 20th century, as well as some unconventional vertical drilling in the early 2000s. In particular, Chemung and Steuben Counties in New York have been sites of significant natural gas development in the Trenton-Black River formation, a limestone formation located even deeper than the Marcellus formation (New York State Department of Environmental Protection, 2003, 2019).

The Twin Tiers is viewed as experiencing parallel trajectories of depopulation and economic stagnation over the second half of the 20th century. However, websites such as *Energy In Depth*, an industry-run public relations platform, contend that Pennsylvania's northern tier counties are now experiencing an economic upswing due to the shale gas boom, even as counties in New York's southern tier continue to stagnate (Jacobs, 2018a,b; see also Craig, 2015; Kennedy, 2018). As Table 3.5 illustrates, this argument is borne out to some extent: the median household income in Pennsylvania's northern tier counties is higher in 2016 than in 2000, while in New York's southern tier median household income is lower. Nevertheless, the median household income is below the state-wide average across all counties in both tiers. Furthermore, according to U.S. Census and American Community Survey 5-year estimates, all but one of these seven counties (excepting Tioga County in Pennsylvania) have continued to experience decreases in population from 2000 to 2016.

Despite these historic, geologic, and economic similarities, a major difference divides New York's southern tier and Pennsylvania's northern tier: namely, the two states' divergent approaches to shale gas development. I end here with a short overview of how each state regulates shale gas development via hydraulic fracturing.

Table 3.5: 2000 and 2016 census data for counties in the Twin Tiers region

County	Population	Median household income[a]	Poverty rate	Unemployment rate
Pennsylvania:		$56,578 (2000) $54,895 (2016)	11.0% (2000) 12.9% (2016)	3.5% (2000) 5.4% (2016)
Bradford	62,761 (2000) 61,808 (2016)	$49,429 (2000) $51,035 (2016)	11.8% (2000) 12.4% (2016)	3.4% (2000) 3.1% (2016)
Susquehanna	42,238 (2000) 41,832 (2016)	$47,432 (2000) $50,160 (2016)	12.3% (2000) 12.9% (2016)	2.6% (2000) 3.1% (2016)
Tioga	41,373 (2000) 42,031 (2016)	$45,172 (2000) $48,449 (2016)	13.5% (2000) 13.4% (2016)	3.6% (2000) 3.9% (2016)
New York:		$61,216 (2000) $60,741 (2016)	14.6% (2000) 14.7% (2016)	4.3% (2000) 5.6% (2016)
Broome	200,536 (2000) 197,381 (2016)	$49,865 (2000) $47,744 (2016)	12.8% (2000) 17.4% (2016)	3.2% (2000) 4.3% (2016)
Chemung	91,070 (2000) 86,742 (2016)	$51,372 (2000) $49,578 (2016)	13.0% (2000) 15.9% (2016)	4.6% (2000) 3.2% (2016)
Steuben	98,726 (2000) 98,151 (2016)	$50,051 (2000) $48,823 (2016)	13.2% (2000) 15.1% (2016)	4.3% (2000) 4.5% (2016)
Tioga	51,784 (2000) 49,649 (2016)	$56,805 (2000) $58,115 (2016)	8.4% (2000) 11% (2016)	3.3% (2000) 4.1% (2016)

[a]2000 values adjusted for inflation to 2016 value
Source: U.S. Census Bureau, Census 2000; American Community Survey, 2016

3.5.2 Pennsylvania unconventional shale gas policy

Pennsylvania has assertively pursued unconventional natural gas development for the past decade, with over 11,000 wells drilled in the state between 2005 and 2018 (Chart 3.4). After decades with no changes to Pennsylvania's oil and gas policy, the Pennsylvania legislature passed a major overhaul of the regulations in February 2012. Known as Act 13, the revisions were passed as an amendment to Title 58 (Oil and Gas) of the Pennsylvania Consolidated Statutes (Pennsylvania Public Utility Commission, 2019). Pennsylvania imposes certain restrictions at various points throughout the shale gas development process. Table 3.6 summarizes these restrictions.

Table 3.6: Pennsylvania shale gas development restrictions

Regulatory Element	Pennsylvania regulations/restrictions
Setback requirements	500 foot setback from wellbore to buildings and water wells 1,000 foot setback from well to public water supplies 300 foot setback from well to streams or wetlands
Predrilling water testing	Not required by state, but if drilling does not happen before development, burden is shifted to operators and alleged contamination is attributed to the well operator
Well casing	Well casing must extend 50 feet below water table; cement type is regulated by state; surface and intermediate casing required to be cemented to the surface; production casing required to 500 feet above hydrocarbon zone
Hydraulic fracturing	Water management plan required "covering the full lifecycle of the water used in shale gas production, including the location and amount of the withdrawal and an analysis of the impact of the withdrawal on the body of water from which it came… [Pennsylvania operates] ecosystem models that provide the basis for rejecting applications for water withdrawals that would put stress on ecosystems" (Richardson, 2013, p. 41)
Hydraulic fracturing fluid disclosure	Operators must disclose percentage by volume of each additive within hydraulic fracturing fluid, using FracFocus website
Wastewater storage and disposal	Storage pits allowed for all fluids; two foot freeboard requirement to limit fluid overflow in case of rain; pit liner thickness is also regulated Little to no underground injection is possible in Pennsylvania due to state's geology, and is regulated by the state Drill cuttings can be disposed through land disposal
Record keeping	Required for five years
Venting and flaring	Discretionary standards, meaning operators are directed to minimize the amount of gas vented to the atmosphere or burned off, but there is no enforceable requirement
Severance tax	No severance tax, but imposes an "impact fee" instead
Well idle time	Wells can sit idle (i.e. not producing) for 12 months before operators must restart production, temporarily abandon the well, or permanently plug the well Temporary abandonment allowed for up to 60 months
Accident reporting	Required within two hours
Local bans and moratoria	Act 13 originally preempted by state law, but this language was struck down by state Supreme Court in 2014
Regulatory bodies	Pennsylvania Department of Environmental Protection (DEP)

Source: Richardson, 2013; Title 58; Chapter 78; PA Act 13

Act 13 contained three key updates to the state's oil and gas laws. First, in lieu of taxing oil and gas companies, it imposes a drilling "impact fee" for each well. The annual per-well amount is based on natural gas prices. Sixty percent of the revenue goes to local municipalities and counties, with the rest distributed among numerous state agencies. Second, Act 13 contains language superseding all local and municipal natural gas regulations throughout the state (StateImpact, 2015). However, the section of Act 13 which stated that local ordinances were

superseded by state law was subject to immediate controversy. The rule states: "The Commonwealth by this section, preempts and supersedes the local regulation of oil and gas operations" (p. 161). Under this ruling, any municipal attempts to zone oil and gas operations would be preempted by state law. A few months after the passage of Act 13, the Commonwealth Court struck down this section of the law which restricted local governments. Then-Pennsylvania Governor Tom Corbett's administration immediately appealed the decision, but the original ruling was upheld in 2014 in the state Supreme Court (StateImpact, 2015).

Finally, Act 13 requires chemical disclosure from natural gas companies, using the industry-run FracFocus website. FracFocus is a web-based database which was developed with funding from the U.S. Department of Energy (Richardson et al., 2013). Pennsylvania is one of fifteen states to currently require chemical disclosure from natural gas companies (ibid.). However, trade secret exemptions exist for chemicals deemed as "confidential proprietary information" (Act 13, p. 94). Furthermore, operators may designate what is considered proprietary information, with little to no oversight from the Pennsylvania Department of Environmental Protection. Additionally, while chemical disclosure reports are required through FracFocus, this information is not publicly available (Hudgins & Poole, 2014).

2.4.3 New York Unconventional Shale Gas Policy

In 2008, then-New York State Governor David Paterson instituted a *de facto* moratorium on shale gas development via hydraulic fracturing: the state's Department of Environmental Conservation would not issue any permits until a thorough review of the environmental impacts was completed (Plumer, 2014). By the end of 2014, Health Commissioner Howard Zucker summarized the report's findings, announcing, "We don't have the evidence to prove or disprove the health effects. But the cumulative concerns of what I've read gives me reason to pause"

(ibid.). These findings led Governor Andrew Cuomo to announce that New York would be extending the moratorium into a permanent ban, making New York the first state with significant natural gas resources do so (Foran, 2014; Neuhauser, 2014).

Local and municipal bans have played a significant role in shaping the natural gas regulatory landscape in New York. According to the state's environmental conservation commissioner, 63 percent of the state's shale gas resources are unavailable due to local bans and moratoria (Kaplan, 2014). In June 2014, the State Court of Appeals upheld the rights of towns to ban fracking using local zoning ordinances, after an energy company and a dairy farm filed legal complaints against local municipal bans (Taylor & Kaplan, 2014). While the state-wide ban is not written into legislation, and could be overturned by a future administration, these highly fragmented municipal policies essentially continue the *de facto* moratorium by making it economically unfeasible for energy companies to drill for shale gas in the state.

Although New York has banned hydraulic fracturing, other affiliated practices such as transportation, processing, and storage are not likewise banned. For instance, plans to store natural gas underneath Seneca Lake proved to be enormously controversial in the New York Finger Lakes region, particularly among the region's grape growers and wineries who worried it would negatively impact agro-tourism in the area (Magnarelli, 2017). Similarly, the Northern Access Pipeline – a proposed 97 mile pipeline to conduct natural gas from Pennsylvania to New York – has been contested in the state, and is currently working through the New York court system (Marcellus Drilling News, 2018). Furthermore, New York state continues to power approximately half its energy with natural gas, primarily sourced from Pennsylvania, highlighting a disparity between the state's natural gas production and consumption (Plumer, 2014). It is important to keep these details in mind when comparing the impacts of shale gas

development across the New York-Pennsylvania state border, as some shale gas development impacts could still be experienced in the New York agricultural landscape.

3.6 Conclusion

While not a perfect comparison, the Twin Tiers region offers a unique opportunity to examine the complex and multi-faceted articulations between top-down regulation, shale gas development, agricultural production, and farmers' perspectives and subject positions. As this chapter outlines, the lack of comprehensive federal policy over unconventional natural gas development has resulted in a highly heterogenous, state-by-state approach to shale gas governance. Consequently, bordering states such as New York and Pennsylvania can both have significant and accessible natural gas resources, yet govern them in completely different ways. The relative dearth of unconventional shale gas drilling in New York's southern tier, compared with Pennsylvania's aggressive development over the last decade, against the region's shared historic and geologic trajectory opens up interesting and unanswered questions about the continuing impacts of shale gas development upon agricultural landscapes. In particular, the Twin Tiers region provides a timely case study to examine the frictions and contradictions at the intersection of food and energy. Namely, what tensions and trade-offs emerge when energy extraction and food production happen within and upon the shared physical space of the farm?

Agriculture is, of course, an extractive industry: farmers extract energy from the land in the form of agricultural products. While many of these products are used to power human bodies, some is also used to produce energy in other forms, such as biofuels and ethanol. The U.S. is currently in the midst of a trend where increasing amounts of once-agriculturally productive land are shifting towards generating wind, solar, and other forms of energy for (primarily) electricity production (Brown et al., 2013; Hitaj and Suttles, 2016). Unconventional natural gas extraction

is but one facet of this broader transformation currently acting upon and reshaping working agricultural landscapes.

To understand these trends, it is necessary to examine them against the context of U.S. agrarian history, and particularly how the agricultural sector has and continues to change. As this chapter notes, the historic allocation of land and power – particularly in the form of sub-surface mineral rights – has uniquely positioned farmers in the Marcellus Region to capture certain economic benefits related to shale gas development through leasing these assets to natural gas companies. At the same time, the relative position of farmers within the agricultural sector, shaped by their business and production practices, creates a highly uneven agricultural landscape in which many (though not all) farmers operate underneath significant financial constraints, which has the potential to constrain their decision-making. Furthermore, the physical juncture of shale gas and agricultural extraction within and upon the same space also makes farmers uniquely vulnerable to certain externalities resulting from shale gas development across multiple and overlapping economic, social, and environmental domains.

This is the backdrop against which farmers as key landowning stakeholders within shale development regions must decide whether or not to facilitate unconventional shale gas extraction on their land. In this dissertation, I seek to peel back and examine the layers of environmental knowledge, key institutions, shale gas and agricultural policies, and farmers' subjectivities to understand how they interact to shape farmers' perceptions and practices. In the next chapter, I present the methodological tools which I employ to analyze these complex interactions across the divergent regulatory landscape of the Twin Tiers region.

CHAPTER 4

MAKING THE CASE FOR CRITICAL Q: PRODUCTIVE TENSIONS BETWEEN CRITICAL DISCOURSE ANALYSIS AND Q METHODOLOGY

4.1 Introduction

Q methodology – a relatively new entrant to human geography – is an innovative mixed method approach used to identify shared worldviews and knowledges. First introduced to human geography through the work of Paul Robbins (2000, 2006; Robbins and Krueger, 2000), Q methodology (hereafter referred to as "Q") uniquely integrates qualitative and quantitative approaches to empirically examine diverse subjective viewpoints that make up complex discourses. Many standard Q scholars argue that Q facilitates "an objective measure of subjectivity" (Ramlo, 2016). However, recent geographical Q research questions these positivist foundations and seeks to make Q more attentive to social context, in part by including reflexive attention to the researchers' own roles in the development and maintenance of uneven power dynamics which shape scholarly inquiry. Two influential papers (Robbins and Krueger, 2000; Eden et al., 2005) have been largely responsible for the introduction of Q to the realm of critical human geography. Much of the work following these papers has indeed employed Q far more critically than earlier users or current practitioners in other fields have done, by analyzing the results as the product of contextually contingent social and power relations (Duenckmann, 2010;

Brannstrom et al., 2011; Brannstrom, 2011; Jepson et al., 2012; Clare et al., 2013; Ward, 2013; Ormerod, 2017; Ward et al., 2017).

Yet within this body of what is arguably a nascent "critical Q" scholarship, there is a significant gap – namely, a silence on the conceptualization and role of *discourse*. Many researchers allude to the discourses they examine (Robbins, 2006; Fisher and Brown, 2009; Cotton & Devine-Wright, 2011; Jepson et al., 2012; O'Neill et al., 2013), with some explicitly stating that they employ discourse analysis as part of their research design (López-i-Gelats et al., 2009; Duenckmann, 2010; Brannstrom, 2011; Clare et al., 2013; Cotton, 2015). However, this paper argues that discourse has been "blackboxed" in this body of Q literature, with researchers focusing nearly exclusively on justifying their use of Q as the lesser-known methodological choice, while neglecting to likewise explain their use of discourse analysis.

To address this gap, this intervention integrates Q with critical discourse analysis (CDA), broadly defined as the analysis of how "truth" is (re)produced through language and practice as an effect of power. CDA recognizes that not all individuals or groups have an equivalent capacity to shape discourse, and seeks to examine how and why such uneven power relations exist and what consequences they entail (Fairclough, 1989). Placing Q and CDA side-by-side exposes gaps, silences, and contradictions that form critical moments for interrogation and query. In juxtaposing these methods, the paper asks what these two methods used in tandem may tell us that, separately, they cannot.

4.2 Mixing methodologies: Theoretical frameworks

Human geography has a long history of employing diverse methodological approaches in research design (Elwood, 2010). Defined variously as attempts to "bridge" between qualitative/quantitative, physical/human, or academic/applied research approaches (Sui and

DeLyser, 2012), mixed methods studies are generally defined as using at least two types of data (e.g. interview transcripts and aerial photographs) or methods (e.g. GIS and participant observation) (Small, 2011). Mixing methods presents unique benefits for and challenges to research design and implementation. Mason (2006) argues that mixed methods research forces researchers to think "outside the box" (p. 13), claiming that analyses working within a single methodological "dimension" are likely to be "impoverished" by limiting researchers' views and capacity for integrating new sources of information (p. 10). Similarly, DeLyser and Sui (2014) claim that an "engaged pluralism" within geography is necessary for disciplinary health (p. 303), with "acrimonious divides" between physical/human geography or qualitative/quantitative methods offering threats to the research enterprise (p. 294). Arguably, the disruption offered by introducing new methodologies and novel modes of framing and addressing research questions has generative potential, by presenting fresh stances and lenses from which to engage and examine issues.

However, attempts to mix methodologies are also likely to encounter theoretical and institutional barriers. Small (2011) names epistemological incommensurability and increased disciplinary specialization as two significant obstacles facing mixed methods researchers. According to Small, the "tight coupling" of certain epistemologies and analytical approaches renders it unlikely that they will be useful outside their disciplinary context, and "heighten[s] the challenges of translation" across disciplines, methods, and epistemologies (p. 78-9). Such factors result in institutional challenges over what is appropriate, rigorous, or valid, and play out amid such "social and political negotiations of power and knowledge" as funding, peer review, publication, and tenure (Elwood, 2010, p. 108).

Despite such challenges, many human geographers scholars have called for more attention to "hybrid geographies" (Kwan, 2004; Sui and DeLyser, 2012). Hybridity offers a "productive stance for negotiating difference" by encouraging a "both/and" mindset, rather than one of "either/or" (Kwan, 2004, p. 756). By seeking out and interrogating "elements thought to be incompatible or conflicting" (Sui and DeLyser, 2012, p. 113), hybrid geographies employ moments of incompatibility, contradiction, or conflict to the researcher's advantage. Such moments approach the epistemological and ontological challenges inherent within mixed methods research as entrance points to unsettle underlying assumptions about what is knowable, how knowledge is formed, and how researchers are complicit in these political projects (Elwood, 2009). Nightingale's (2003) study on land use and community forestry in Nepal provides an illustrative example. Nightingale employs aerial photography interpretation and ecological oral histories, arguing that "no one method could hope to capture both ecological change…and the social-political complexities that are co-productive of ecological conditions" (p. 80-1). Noting that these two methods are embedded within different – even opposing – epistemologies, Nightingale places the silences and partial knowledges of each method into productive tension. Together, these two methods and their seemingly contradictory findings "revealed far more about the political and social struggles" around power and control over forest resources and land use "than either one did in isolation" (p. 82).

In the case of Q, this intervention argues that the silences, gaps, inconsistencies and incompatibilities which emerge from seemingly divergent epistemological approaches afford a unique opportunity to critically interrogate "blackboxed" methods – those aspects of our methodological choices that become rote and routinized to the degree that their inner workings are obscured (Latour, 1987). The use of new methods to unsettle and disrupt research design

allows researchers to query what have become unquestioned aspects of research conduct (Bryman, 2006). Eden et al. (2005) note that, as a new entrant to human geography, Q's "application must be consciously and reflexively worked through, unlike more familiar methods" (p. 420). This is a "healthy move" for methods, as more familiar methods such as surveys or interviews may be "naturalized and neglected," becoming "so commonplace…that researchers frequently feel able to dispense with a methodological justification" (p. 420-1). However, while Q is relatively new to human geography, it is not itself a new method, and in fact has an established and highly codified protocol.

4.3 Q methodology: History and process

Q is a mixed methodological approach that uses factor analysis to analyze subjective viewpoints about a given topic, and thereby identify shared worldviews among the study participants. To measure human subjectivity, Q analyses generally ask participants to rank-order a series of subjective statements – the study's *n* – creating "snapshots" that can be compared using inverted factor analysis. The resulting clusters of individual responses, known as *factors*, represent shared perspectives among the participants who sorted the statements along a similar pattern (Watts and Stenner, 2012).

Q follows a highly codified, standardized protocol. While its implementation varies somewhat, most Q analyses use a version of the following steps, adapted from Robbins and Krueger (2000):

1. Identify the study's "*domain of subjectivity*," i.e. the topic of study (Robbins and Krueger, 2000, p. 638).

2. Generate the *concourse*, a selection of interrelated discursive statements representing the breadth of viewpoints on the topic of study that are "drawn from participants' views"

(Robbins and Krueger, 2000, p. 639). Statements are typically sampled from interviews with key stakeholders, as well as other relevant texts such as media accounts, websites, policy documents, and written comments.

3. Create a representative *Q set* of approximately 40-60 qualitative statements originating from the concourse. Many studies employ a grounded theory approach (Corbin and Strauss, 2008) to generate themes present in the concourse, then select an equivalent number of statements from each theme to ensure that the final Q set captures the full range of views present in the concourse.

4. Ask study participants to complete *Q sorts* in which they rank the Q set statements, each printed on a separate, numbered card, on a forced choice distribution board from "most like my view" to "most unlike my view". Participants are selected using purposive and non-random sampling, since the goal of Q is to identify how respondents bundle together qualitative statements to form worldviews, rather than determine the rates at which these views appear in the population. Researchers aim to select participants that represent the widest "range of interests, professions, and formal positions" possible in order to include a diverse set of perspectives (Robbins and Krueger, 2000, p. 639).

5. Conduct semi-structured interviews immediately following each Q sort to elicit participants' reasoning for how they placed the statements. Semi-structured interviews provide in-depth qualitative data from individual participants, supplying valuable context and nuance for the following interpretation of the Q study results.

6. Analyze the completed Q sorts using PQMethod (Schmolk, 2002) or other dedicated analytical software packages to extract shared perspectives among the broader participant group, known as *factors*. Once a mathematical solution is identified, PQMethod creates *factor arrays* in

which all Q sorts associated with that factor are combined using weighted averaging to create a composite Q sort for each shared perspective. Factor arrays resemble completed Q sorts, with each encompassing a specific viewpoint. Interpreting each factor is a process of holistically examining all statements within the factor array, how they relate to each other, and how its patterns relate to other factors (Watts and Stenner, 2012).

7. Show the preliminary Q study results to participants, either individually or in a focus group, for additional iterative layers of interpretation, verification, and participation.

4.2.1 Q in Human Geography: Rendering Social Theory Empirical

William Stephenson, a psychologist and physicist who developed Q in the 1930s, argued that "Q was 'objective' since it appeared to create entirely empirical access to the mind of the researched without the bias and reduction from the theorist/researcher's imagination" (Robbins and Krueger, 2000, p. 642). By asking participants to sort their own statements drawn from earlier interviews, the researchers and their attendant biases and theories are seemingly separated from the data, allowing participants "to speak through 'pure' unfiltered empiricism" (Robbins and Krueger, 2000, p. 642). Following the lead of Stephenson and his students (Brown, 1980), many Q practitioners laud Q for its ability to "remove" or "reduce" researcher bias. For example, an early, influential paper views the standard use of a "concourse matrix" serves "as an independent method for choosing statements, and so minimizing (but of course not completely eradicating) researcher bias" (Barry & Proops, 1999, p. 340; see also Brown, 1980; McKeown and Thomas, 2013). Similarly, Ward et al. (2017) note that, while researcher subjectivity may influence choices such as statement wording or factor interpretation, Q follows "standard protocols for reducing potential researcher bias" (p. 4) such as employing a grounded theory approach. Further, Ramlo (2016) argues that, while researchers may impose *a priori* meaning

onto their selected statements, these meanings are "unknown to the participants" (p. 33). Since participants complete the Q sort ignorant of these meanings and assumptions, they instead "[inject] their own meaning into the statements based on their experiences" (p. 33). However, recent Q studies conducted in the critical social sciences question these positivist foundations and assumptions.

Q has a small but growing presence in human geography, particularly within the subfield of human-environment interactions. Q has been employed to examine such diverse topics as rurality and rural geography (Previte et al., 2007; López-i-Gelats et al., 2009; Woods, 2010; Duenckmann, 2010; Milcu et al., 2014), the production of environmental knowledge (Robbins 2000, 2006; Eden et al., 2005; Forrester et al., 2015), perceptions of environmental risk (Hall, 2008; Venables et al., 2009; O'Neill et al., 2013), energy development (Ellis et al., 2007; Fisher and Brown, 2009; Wolsink and Breukers, 2010; Brannstrom et al., 2011; Cotton and Devine-Wright, 2011; Jepson et al., 2012; Frate and Brannstrom, 2017), environmental management and governance (Steelman and Maguire, 1999; Bischof, 2010; Brannstrom, 2011; Clare et al., 2013; Sandbrook et al., 2013; Ward, 2013; Frate and Brannstrom, 2015; Fry et al., 2017; Ormerod, 2017; Ward et al., 2017), and resource extraction (Chapman et al., 2015; Cotton, 2015). Such work illustrates how researchers productively apply Q to transgress qualitative/quantitative dichotomies in geographic research (Woods, 2010) by supplementing, rather than seeking to replace, the qualitative methods commonly employed in the field. For example, Q is frequently deployed in tandem with semi-structured interviews to generate statements for the concourse (Step 2), following the Q sort to elicit the participant's rationale for how they sorted the Q set items (Step 5), and to check preliminary findings with study participants (Step 7). Q has also been successfully combined with numerous other qualitative and quantitative methods, including

questionnaires (Hall, 2008), participant observation (Ward, 2013), discourse analysis (López-i-Gelats et al., 2009; Clare, 2013), focus groups (Lehrer and Sneegas, 2017; Ward et al., 2017), photographic analysis (Robbins, 2000; O'Neill et al., 2013), geographic information systems [GIS] (Hawthorne et al., 2008; Fry et al., 2017), and participatory mapping (Forrester et al., 2015).

One of the benefits of Q as it is practiced in human geography is that it "renders empirical" certain hard-to-measure concepts (Robbins and Krueger, 2000, p. 644). In this way, Q allows critical geographers to empirically test and measure social theory. For example, Robbins (2000) observes that "environmental knowledge is hard to measure" (p. 132). Yet by viewing each factor as a "proxy" for a different form of knowledge, Robbins successfully uses Q to identify and compare divergent environmental knowledges (see also Robbins, 2006). In another case, Duenckmann (2010) employs Q to measure the social construction of rurality among residents of a German town. According to Duenckmann, Q makes diverse and opposing social constructions of rurality "tangible" through an empirical yet non-essentializing approach (p. 285). Jepson et al. (2012), meanwhile, use Q to test Agrawal's (2005) environmentality thesis by examining whether the wind energy development "boom" in west Texas has reshaped environmental subjectivities. Such examples illustrate how Q, when used creatively in ways that "move beyond" its standard use (Jepson et al., 2012, p. 855), yields results difficult to produce with traditional qualitative or quantitative methods alone.

Discourse analysis is another qualitative method frequently used alongside Q. However, this paper argues that discursive analysis has been "blackboxed" within much of the Q literature in human geography and related disciplines. The remainder of the paper examines the potential for critical discourse analysis, or CDA, to interrogate such blackboxed methodological moments.

4.4 Critical discourse analysis

One prominent method to emerge as part of the "qualitative turn" in human geography is critical discourse analysis, or CDA, which aims to analyze "the significance of language in the production, maintenance, and change of social relations of power" (Fairclough, 1989, p. 1). CDA investigates linkages between language, ideology, and power by examining how linguistic conventions provide a means of creating, legitimating, and preserving uneven power relations – in other words, how language serves as "the primary medium of social control and power" (Fairclough, 1989, p. 3). In that sense, language is inherently political, with significant implications for the experience and appropriation of power, authority, and control.

"Discourse" is a complex and contested concept. Gee (2010) distinguishes between "little" discourse – what he terms "language-in-use" or "how language is used 'on site' to enact activities and identities" – and "big" Discourses, or the ways that "little" discourse is integrated with, and enacts, broader ideologies and meanings (p. 7). CDA views discourse more in line with Gee's "big" Discourse as a complex and multifaceted mode of representation that conveys meaning. CDA also overlaps in key ways with Foucauldian discourse analysis, which examines "the production of knowledge through language" as an effect of power (Hall, 1992, p. 291; Foucault, 1975, 1980). From this standpoint, the production of "particular knowledge systems" works to "convince people about what exists in the world" – in other words, what counts as "truth" – thereby shaping individual attitudes, practices, and their associated meanings (Waitt, 2010, p. 218).

Discourse is communicated through such artifacts as "written texts, spoken words, pictures [and] symbols" (Phillips and Hardy, 2002, p. 4), as well as non-written texts such as landscapes, architecture, music, and practices (Fairclough, 2013). Yet such texts should not be

analyzed in isolation: discursive texts co-exist through "intertextual relations" within networks of other discursive artifacts (Fairclough, 1989, p. 155). Thus, texts are always in dialogue with many other texts extending beyond written or spoken language, held together within and through the broader discourse. Discourse itself must therefore be understood as "a complex communicative event that also embodies a social context" characterized by diverse "production and reception processes" (van Dijk, 1998, p. 2). From this perspective, heterogeneous and intertextual discursive texts are contingently produced and interpreted within specific socio-historical contexts which give them meaning. CDA thus does not take discursive texts at face value, but examines them within their social *milieu* to understand how, by whom, and why certain discourses are (re)produced and (re)interpreted.

Unlike Q method, CDA does not adhere to a strictly codified protocol – in fact, Foucault's descriptions of discourse analysis are notoriously vague (Waitt, 2010). Similarly, many CDA textbooks do not spell out specific guidelines on the basis that to do so would be overly restrictive (Phillips and Hardy, 2002). Rather, CDA is frequently "held to become intuitive" with experience (Waitt, 2010, p. 219). The unwillingness of CDA practitioners to describe a standardized protocol has led to the "black box treatment" of discourse analysis (Steacy et al., 2016, p. 166). To the uninitiated, CDA may therefore appear impenetrable, messy, and even methodologically unsound (Phillips and Hardy, 2002).

While acknowledging that CDA is an inherently disordered endeavor, Steacy et al. (2016) conclude that "this untidiness is one of [its] greatest assets" (p. 169). The authors highlight "the iterative, emergent, and dialogic properties of a processual engagement with a text" as central to a rigorous discursive analysis (p. 166). A key aspect is the engagement with discourse analysis as a processual "series of critical encounters with [a] text" (p. 169). The cyclical return to texts

multiple times, and the subsequent, iterative building of layers of meaning emerging from a text's intertextual ties to myriad other texts, is at the heart of the authors' claim that "discourse analysis cannot be confined to one moment in the research process," but rather becomes "a dynamic and formative interaction between analyst and discourse" (p. 172). Yet as this paper argues, CDA's "messiness" is a productive contradiction when placed alongside Q's highly standardized protocol.

4.4.1 Discourse and Q Method

Discourse analysis, when engaged in Q studies, tends to be described superficially if at all. In the sample of papers included in this analysis, few Q studies explicitly explain how the authors conceptualize or define discourse, or outline in any detail how they employ discourse analysis. The analysis concludes that discourse analysis has been blackboxed in this body of scholarship, which is likely attributable to two causes: 1) space constraints within journals which lead authors to focus on justifying their use of a new and relatively little-known methodology, and 2) inheriting a different conceptualization of "discourse" from the Q literature than is generally employed in CDA. It is the latter that this section seeks to clarify and amend.

By and large, Q studies define and use the term "discourse" in a manner quite different from CDA. In standard Q, "discourse" refers to "a set of views and attitudes on a particular topic" – in short, what is purportedly captured in a Q study's extracted factors (Addams, 2000, p. 14-15). Addams writes: "[Discourses] represent the way a particular individual, in a particular time, relates to, and forms conceptions of, certain aspects of the world," noting that among individuals who share experiences and traits "there may be some degree of communality or sharing of discourses" (p. 15). Standard Q analyses thus generally use "discourse" as a synonym for the shared worldviews extracted through by-person factor analysis. This use diverges sharply

from CDA, which views discourse as an interconnected system of diverse texts that together (re)produce and maintain meaning, knowledge, truth, and power.[13]

The deployment of discourse as a concept across Q studies within human geography is wildly uneven. Some analyses employ the standard Q definition of discourse (Ellis et al., 2007; Hall, 2008; Sandbrook et al., 2013) while others appear to be more compatible with CDA (López-i-Gelats, 2009; Duenckmann, 2010; Brannstrom et al., 2011; Jepson et al., 2012). One example of this second approach is Robbins' (2006) work on environmental knowledges. In his paper on wildlife conservation in Yellowstone, Robbins draws on Hajer's (1997) work on "discourse coalitions," or the process through which "environmental consensus emerges as historically disparate groups settle on [shared] coherent stories" (Robbins, 2006, p. 197). Robbins employs Q to illustrate that although divergent groups, such as hunters and environmentalists, share similar views on "wilderness" and conservation, they fail to form a discursive alliance in the wildlife management debate. According to Robbins, these stakeholders are not just *producing* discourses that (de)legitimate certain forms of environmental knowledge, but are simultaneously themselves the *product* of those same discourses.

Brannstrom (2011) extends Robbins' analysis in the context of Brazilian industrial agriculture. Brannstrom notes that Q is uniquely suited to examine "the linkages between discourses and policy outcomes," and employs it to test Robbins' two conclusions: 1) "environmental discourses are not attributable to an actor's structural position" but are instead "deeply held and contested truths," and 2) "shared discourses among key actors will not

[13] In one notable exception, Cotton (2015) situates his choice to name individual factors as "discourses" – the only analysis to do so, as far as this author is aware. However, Cotton notes that Q "examines discourse at the micro-level: concerning shared conceptualisations, language use and communicative practices" (p. 1948). Cotton argues, "Q-method thus has particular value in relating the micro-level discourses from participant sorting…back to underlying macro-level environmental discourses" (p. 1948). It is worth noting that Cotton's description of micro/macro discourses parallels Gee's (2010) separation of "big" and "little" discourses.

necessarily lead to resolution of governance conflicts" (p. 532). While Brannstrom's analysis does support Robbins' claim that shared discourses do not inherently result in coalitions due to the idiosyncratic and deeply personal meanings individuals attribute to discourses, he also finds that actors' structural positions shape, but do not determine, their perspectives.

While both Robbins (2006) and Brannstrom (2011) employ discourse analysis in a critical fashion, their uses of discourse analysis and how it informs their Q studies remain obscured. Clare et al. (2013), on the other hand, explicitly combine discourse analysis with Q to critically examine "balance discourses" among wetland management stakeholders in Alberta, Canada. The authors argue that Q may "[allow] for a more structured analysis of discourse" by examining how key stakeholders are positioned relative to the extracted factors to illuminate power relations (p. 40). Clare et al.'s research design offers a glimpse of how CDA and Q may be productively used in tandem. The authors first conduct a series of semi-structured interviews that, when inductively coded, "revealed a very strong discursive element related to the perceived need to 'balance' industrial development and wetland management" (p. 43). This "balance discourse" becomes the focus of the subsequent concourse and Q set, facilitating an empirical examination of how "balance discourse" produces a dichotomy between industrial development and environmental conservation. The authors argue that this binary has resulted in "a policy discourse that has been dominated by concerns over what the industry stands to lose, rather than what the public stands to gain" (p. 48). However, Clare et al. (2013) do not describe to what extent discourse analysis is used in subsequent steps in the Q study, such as interpretation. Discourse analysis informs their Q study's design, but is not explicitly invoked at any other stage.

4.5 Critical Q methodology

As the papers described above illustrate, Q analysis as currently practiced within human geography and the broader critical social sciences could greatly benefit from a closer articulation with CDA. This section examines four moments within standard Q practice where CDA could be productively deployed. The resulting "critical Q method" aims to retain the most useful features of Q, while improving its facility to engage the uneven power relations giving rise to the worldviews it co-produces.

One of the real strengths of a well-designed Q study is its iterative quality, as each stage builds on previous steps in a cyclical fashion. This echoes the iterative nature of CDA, whereupon "sets of meanings… continuously enrich as well as potentially upset previous interpretations and framings" (Steacy et al., 2016, p. 169). However, Q is essentially a method of simplification, which seeks to identify a small number of shared viewpoints across a highly heterogeneous landscape of idiosyncratic knowledge claims and deeply personal worldviews (Robbins, 2006). CDA, on the other hand, is inherently "messy" and resistant to uniformity, which is arguably one of its greatest assets (Steacy et al., 2016). Counterpoising the tidiness of Q and messiness of CDA introduces moments of productive tension, whereby CDA may be used to "confuse" Q, making it more forgiving of "disorder" (Sui and DeLyser, 2012, p. 116). By introducing moments of disruption to "disturb" standard Q practice, introducing CDA at key moments can interrogate rote and routinized practices, realign relationships and assumptions, and break open Q's black boxes. Rather than codifying and thereby limiting the ways CDA may be introduced and applied within Q, this section highlights four moments or processes within standard Q protocol that would benefit greatly from the disruption and disturbance of CDA. These stages build on each other iteratively and dialogically, adapting standard Q protocol into

"a series of critical encounters" between the researcher, participants, texts, and discourses (Steacy et al., 2016, p. 169).

The first moment concerns creating the Q concourse (Step 2) and Q set (Step 3), which form the discursive foundation of the Q study. The choices made in these steps continue to influence each following stage of the research process. Crafting the concourse inherently involves some form discursive analysis, as the researcher must produce and/or identify texts (interview transcripts, news articles, policy documents, websites, newsletters, discussion forums, etc.) and analyze them to inform and structure the final Q set. Practicing CDA at this stage involves compounding critically reflexive stages of choosing source materials, identifying and suspending pre-existing categories, and conducting multiple layers of coding to identify emergent themes. Perhaps most crucial is 1) the processual identification of inconsistencies, silences, and gaps within these texts, and 2) the recognition and analysis of truth and power effects (Rose, 2001). Without these essential critical moments, researchers run the risk of reproducing the same silences, inconsistencies and truth/power effects within their study.

Second, CDA has the potential to yield generative insights during the production and analysis of Q study data, namely interview transcripts and field notes. A CDA approach asks the researcher to view these data as *dialogic*, co-produced between the researcher, participants, and discourse (England, 1994). In Critical Q, researchers revisit their research texts processually and iteratively, coding numerous times over the course of fieldwork to build multiple, compounding layers of interpretation and meaning. The themes, meanings, silences, and inconsistencies identified in early interviews and field notes inform the production and interpretation of later research texts; likewise, later research texts prompt researchers to revisit early interviews and field notes, examining them with fresh perspectives. Further, the insights garnered from multiple

and iterative layers of interpretation may be used to revisit the texts used to produce the concourse and Q set. While the Q set itself cannot be altered without losing the ability to statistically analyze early Q sorts, new insights may be included and explored via post-sort interview prompts and questions.

Third, analyzing and interpreting the Q sorts offers a key moment for integrating CDA into Q protocol. The insights, meanings, gaps, and inconsistencies identified in the discursive texts sampled for the concourse, as well as the interviews and notes produced "in the field," will at this point inform how the factor arrays – the weighted and averaged combination of all Q sorts associated with a world view – are interpreted. Each factor array illustrates how discursive statements from the Q set are bundled together in diverse ways to form an "idealized" worldview. CDA is crucial to interpret each worldview in the context of the uneven social and power relations through which it is produced. This includes the context of the Q study itself: critical reflexivity is essential at this stage to examine how the researcher's choices when constructing the Q set influence the framing and production of each worldview.

The fourth and final intersection of CDA and Q builds on the individual factor array interpretations to examine how they together illuminate "big" Discourse (Gee, 2010; see also Cotton, 2015), thereby (re)producing and interrogating meanings, knowledges, and power/truth effects. A CDA perspective views this discourse as "emergent": the "multiple shifting iterations" embedded throughout the critical Q process cause "insights to 'emerge'…that [are] situated by the contextualized meetings between analyst and text" (Steacy et al., 2016, p. 170). It is also co-produced between researcher, participants, and texts – thus, the researcher must engage reflexively to understand how they are necessarily implicated in the very discourse(s) they analyze, and the discursive representations (such as Q sorts) they generate.

4.6 Interrogating critical Q methodology: Contradictions, silences, and limits

As Elwood (2010) notes, mixing methods offers unique epistemological and ontological challenges. Using methods together which stem from divergent theoretical backgrounds has the potential to unsettle assumptions about what is knowable and how that knowledge is or should be produced. As a result, successfully mixing methods requires sustained critical reflexivity if the researcher plans to productively and responsibly interrogate epistemological or ontological tensions (England, 1994).

The positivist foundations of Q, which assert that Q "removes" or "diminishes" researcher bias, permit researchers to elide acknowledging this responsibility by framing the resulting factors as "objectively" determined. Q's use by constructivist researchers, on the other hand, confronts the supposed "objectivity" of standard Q practice, exposing moments of incompatibility. Central to the ability to speak across this tension, however, is the researcher's capacity to be critically reflexive regarding their own positionality within the critical Q protocol. A central tenet of critical Q is to employ CDA as a reflexive strategy to understand how the researcher is inextricably implicated throughout the research process.

Critical Q rests upon the perspective that "objectivity" is a construction, and therefore seeks to decenter Q from its positivist foundations to facilitate an anti-essentialist research agenda. The fundamental premise of critical Q is that "the subjectivity of the researcher is therefore to be valued rather than elided" (Eden et al., 2005, p. 421), incorporated into the iterative stages of CDA and Q analysis as a valuable source of data. Constructing the concourse/Q set and selecting texts and participants, for example, are inherently "subjective and reflexive judgments" which necessitate a continued, reflexive engagement with the researcher's positionality (Eden et al., 2005, p. 421). The iterative, cyclical qualities of both Q and CDA

indicate that the researcher's choices while constructing the concourse and Q set will continue to reverberate throughout each subsequent stage of the research process, inevitably shaping the discourse(s) produced throughout the research encounter and thereby necessitating a robust attention to reflexivity and positionality.

More reflexive work is also needed to understand how Q is complicit in *producing* and *reconfiguring* the perspectives and knowledges it analyzes, rather than simply "uncovering" or "revealing" them. For the most part, Q-practicing researchers have been silent on how Q identifies, produces, and reconfigures the worldviews under study.[14] In the moments of category formation – where the researcher extracts a factor array, names it, and interprets it – researchers are active participants in the creation and framing of the perspectives and discourse(s) produced through their research. Moreover, these results – the factor arrays, and the discourse(s) they outline – are inherently and necessarily incomplete. It is impossible to ensure that all perspectives are included or represented. Rather, the extracted factors and resulting analysis are borne of the researcher's situated encounters with the texts and participants. The results are shaped by their own partial, contingent knowledges which inevitably render some aspects evident, and others invisible or silent.

Such reflexivity is particularly important to evaluate analyses where Q is used for "giving voice" to marginalized knowledges and discourse obscured by more dominant worldviews (Woods, 2010). From this perspective, Q plays a key role in highlighting non-dominant perspectives for policy makers, thereby helping to de-center hegemonic ways of knowing the world, and may therefore be regarded as compatible with feminist and participatory research

[14] However, see Ormerod (2017). In her study of Gramscian "common sense" principles shaping water recycling governance, Ormerod notes that her Q results "provide an artificially coherent frame around common sense notions that are fundamentally contradictory and continually renegotiated" (p. 78).

efforts. Yet, Q is not inherently participatory or decolonizing – like any methodology it can be, and has been, employed in top-down, colonizing, and oppressive ways. By bringing CDA to bear upon standard Q practice, critical Q therefore seeks to answer Lawson's (1995) call for "empiricist feminism" by reconfiguring and "uncoupling" quantitative methods from masculinist, positivist knowledge production processes (p. 450). Critical Q likewise works to triangulate between numbers and text to produce narratives that are sensitive to marginal perspectives and knowledges by examining them as situated and contingent to socio-historical contexts, rather than seeking to analyze them as though disembedded and alienated from their life-worlds (Rocheleu, 1995; Previte, 2007).

It follows that critical Q is a method with significant potential in the realms of policy and application (Brown, 1980; Addams and Proops, 2000; Dryzek and Niemeyer, 2008). By examining how different worldviews converge and diverge, Q may be useful in highlighting and negotiating areas of consensus within highly contentious debates (Lehrer and Sneegas, 2018). Further, its unique blend of qualitative and quantitative data works to clothe critical, qualitative narratives in the trappings of quantitative representation, which is frequently privileged in the realms of policy (Eden et al., 2005). In this sense, Q engages "strategic positivism" (Wyly, 2009), functioning as a methodological Trojan horse by "rendering empirical" the subjective experiences and knowledges of marginalized groups (Robbins and Krueger, 2000).

Yet while a critical Q perspective views the categories it produces as dynamic, partial, and constructed, there is a danger that these categories could be essentialized and "weaponized" (Bryan and Wood, 2015). By rendering marginalized knowledges legible to the state or to capital, their potential appropriation and exploitation is a significant concern. Additionally, Q findings are not generalizable, nor have they ever been intended to be so. Rather, they are

inextricably embedded within their particular socio-historical context (Previte et al., 2007) – that is, the context of the research project itself. Thus, a further concern is whether and to what extent policymakers or other actors may attempt to wrongly extrapolate a Q study's findings to broader populations.

4.7 Critical Q methodology in action

To provide a concrete example of critical Q in action, I provide here an overview of the study design used in this dissertation. In this section, I illustrate how critical Q is deployed across three major domains: 1) constructing the study's concourse and Q set, 2) data collection with Q sorts and semi-structured interviews, and 3) data analysis and interpretation.

4.7.1 Concourse & Q set construction

Producing the concourse and Q set illustrates the first intersection of Q and CDA outlined above (see Section 4.5). The Q concourse and Q set (Steps 2 and 3 of the standard Q process, respectively) form the spine of the broader Q study, as decisions made during this process will shape and constrain the texts and data produced in later stages of the study. Furthermore, employing CDA to disturb and interrogate standard Q practice at these stages highlights and enables critical reflection on the researchers' cyclical and iterative encounters with the discursive texts analyzed and produced in this process.

To build the study concourse, I conducted fourteen semi-structured interviews and three site visits to farms and shale gas well pads in New York and Pennsylvania during Summer 2015. The interviews and field notes were later transcribed and coded. I conducted these pilot interviews with purposively selected key stakeholders at the intersection of hydraulic fracturing and agriculture in the Twin Tiers region. Participants included farmers representing both conventional and non-conventional production techniques, as well as those who had both leased

and not leased their subsurface mineral rights for natural gas extraction; Cooperative Extension agents and researchers involved in shale gas education efforts in both states; and land grant college researchers conducting research on the impacts of shale gas in the region. These interviews helped me refine the scope of the study's "domain of subjectivity" (Robbins and Krueger, 2000, p. 638) and overarching research focus, which investigates how farmers' environmental subject positions are changing (or not) due to the perturbation of shale gas development. Specifically, these interviews allowed me to develop my central research question, which asks: What discourse(s) are deployed at the hydraulic fracturing/agriculture juncture, and how do they reveal different forms of knowledge among farmer-landowners in the Twin Tiers region?

In addition to the interview transcripts and field notes generated through these site visits, I identified supplementary texts to sample for the concourse. These texts included articles, reports, websites, blogs, discussion forums, and policy documents from national and regional news sources (*New York Times*, *National Public Radio*, *The Oneonta Daily Star*, *The Pittsburgh Post-Gazette*, and *The Philadelphia Inquirer*) and online sources representing a range of institutions and stances towards hydraulic fracturing ("Fracking" Subreddit, Energy In Depth, American Farm Bureau Association, Pennsylvania Association for Sustainable Agriculture, Pennsylvania Independent Oil and Gas Association, Penn State Marcellus Center for Outreach and Research, Cornell University Cooperative Extension Natural Gas Resource Center). The combination of interview and field note transcripts with these additional discursive texts informed the preliminary critical discourse analysis, by identifying silences and gaps within these texts and analyzing how they frame shale gas development and thereby produce "truth" as an effect of power (Rose, 2001).

The first stage of inductive coding revealed a key binary division framed between economic benefit and environmental degradation as a central discursive element shaping public debate over shale gas development. Two major themes pertaining to how farmers were represented in the context of shale gas development were also identified: 1) economic struggle and 2) environmental stewardship (Sneegas, 2016). Within each theme, the "family farm(er)" is deployed as an appealing discursive symbol transecting the pro/anti drilling binary. The "family farm(er)" is leveraged by stakeholder groups to first frame the shale gas development "problem," thereby designating certain solutions as desirable and necessary. For example, pro-drilling narratives frequently deploy the "struggling family farm" as economic justification for increased drilling, against its discursive counterpart: the once-struggling farmer "saved" by per-acreage signing bonuses and gas royalties. Framing the problem as an *economic* one necessitates a capital-intensive solution, made possible through the royalties and per-acre signing bonuses available through shale gas development.

Anti-drilling advocates also deploy the economic struggle of family farms, yet do so by instead framing the problem as *environmental*, with farmers who lease their subsurface mineral rights facing financial risk should their water, land, or livestock be contaminated. This narrative also draws on the theme of environmental stewardship, by portraying farmers as guardians of the land, protecting its natural resources from extractive industry. Using such words as "pristine" and "bucolic" to describe the agrarian landscape highlights the environmental dangers posed by shale gas development to both the natural resources required for safe agricultural production, and the rural character of the region. While pro-drilling narratives also employ an "environmental stewardship" theme at times, they do so through an *economic* lens, claiming that farmers would never endanger their livelihoods by putting their land or associated natural resources at risk.

Themes of economic struggle and environmental stewardship, and the ways they are deployed within both pro- and anti-drilling accounts, illustrate how the economy/environment binary shapes and constrains public debate over shale gas development via hydraulic fracturing. Such dichotomies are reductive, diminishing complex topics such as shale gas development to bipolar for-and-against narratives. In this way, binaries obscure nuance by flattening varied perspectives and locking stakeholders into pre-determined and seemingly mutually exclusive frames. Viewing and representing topics with and through dualisms thus impoverishes discourse by erasing non-binary perspectives and potential moments of convergence and consensus.

Binary divisions such as the economy/environment dichotomy also function as an effect of power. In addition to foreclosing the potential for resolution, dualisms impair efforts to deconstruct and address the uneven power and social relations which generate such binaries in the first place. By way of illustration, Clare et al. (2013) describe how a wetland protection "balance discourse" has produced a dichotomy between industrial development and environmental conservation. The authors argue that this binary has resulted in "a policy discourse that has been dominated by concerns over what the industry stands to lose, rather than what the public stands to gain" (p. 48). Further, the authors claim that attempts to surmount this dualistic discourse "will be difficult in the face of existing power structures" (p. 48). Similarly, the production of an economy/environment dichotomy within shale gas development and agricultural production discourse reinforces existing landscapes of power, by creating powerful discursive coalitions between gas industry and policy stakeholders – groups that historically have much greater access to political resources than environmental non-profits.

Given the prevalence of the discursive economy/environment binary in framing the fracking debate, I chose to structure the final Q set in such a way that it both drew on, and sought

to identify perspectives outside of, the narratives produced through its bipolar lens. I sampled the included texts for subjective statements indicating opinions on the perceived relationship between shale gas development and agricultural production, resulting in a final concourse of 614 statements. To create the Q set, I applied a grounded theory approach (Corbin and Strauss, 2008), producing four major themes and twenty-five subcategories:

1. Risks and Benefits of Hydraulic Fracturing (general, environmental, health, social, economic, safety, political)
2. Institutional Roles (industry, government, academia, cooperative extension, policy, Environmental Protection Agency, environmentalist organizations, media)
3. Politics of Knowledge (expertise, role of education, technology, authority, trust, politics of contestation)
4. Food and Agriculture (production practices, energy, economics, environment)

Each subjective statement in the concourse was coded using the identified themes and subcategories as preliminary codes. To both acknowledge and account for the presence of the discursive binary between pro- and anti-drilling positions, each statement was assigned an additional code according to its orientation towards shale gas development (on a scale of 0-5, with 1 denoting strongly pro-drilling, 5 denoting strongly anti-drilling, and 0 denoting an unknown position). For example, Statement 28 ("I'm worried that we are turning from an agricultural region to an industrial region") was assigned the codes *social risk*, *economic risk*, *food and agriculture – economics*, and *food and agriculture – environment*, and assigned an orientation of 4 indicating "somewhat anti-drilling." These themes and categories were used to structure the final Q set by selecting a roughly equivalent number of statements from each theme, as well as across the spectrum of orientations to shale gas development and agricultural

production methods. This was accomplished by grouping all statements assigned a particular code (e.g. “environmental risk”), ordering them along the spectrum of pro- to anti-drilling stances, then removing statements that were repetitive, too narrow, too broad, or which overlapped in content or position. In this manner, the original concourse of 614 statements was condensed to a final Q set of 57 statements over seven iterative coding cycles (Appendix A.1).

Many statements in the final Q set were reworded for clarification. For example, all statements containing a negative orientation (e.g. “I do not”) were reworded to avoid the potential for producing confusing double negatives while completing the Q sort (e.g. putting an “I do not” statement under the “most unlike my view” column). Further, when taken directly from interviews, many statements were overly long, complex, or vague. To illustrate, Statement 29 (“Well-off ‘fracktivists’ just want to keep the landscape looking a certain way”), sampled from an *Oneonta Star* newspaper article, originally read: “You could look at the fracking debate as class warfare – well off people just want to keep the area looking a certain way, and are unconcerned about what will happen to the poorer residents if they aren’t allowed to sign leases.” Since the Q set contained other statements on economic inequality relating to shale gas development (e.g. Statement 5: “Royalty payments from shale gas development have really increased inequality among farmers”), the revised statement focused instead on the subjective position that anti-drilling activists are trying to prevent changes to the local landscape, indicating a “Not In My Backyard” stance towards industrial development (Davis and Bali, 2008).

The final Q set aims to represent as fully as possible the breadth of topics and stances relating to agricultural production and shale gas development. However, it is important to emphasize that this Q set – and the concourse from which it derives – are necessarily situated

and partial, bounded by the texts from which they were drawn, and by my own choices as the researcher in identifying and analyzing the texts and subjective statements within them.

4.7.2 Participant sampling strategy

In the second round of data collection, I administered Q sorts, short demographic questionnaires, and post-sort semi-structured interviews. The shortest interaction with a participant lasted sixty minutes, and the longest lasted four hours. To identify participants for the second round of data collection, I contacted participants from the first round of interviews who fit the updated geographic inclusion criteria. I included prior participants either lived or worked in a seven county region within the Twin Tiers area of New York and Pennsylvania (Broome, Chemung, Steuben, and Tioga in New York; Bradford, Susquehanna, and Tioga in Pennsylvania). I also included agricultural extension educators and researchers at The Pennsylvania State University (Penn State) and Cornell University (Cornell) – the land grant colleges for Pennsylvania and New York, respectively. Of the fourteen pilot interviews from 2015, six participants were both available and fit the new inclusion criteria.

I conducted purposive snowball sampling with these core participants to identify additional participants in the Twin Tiers study area[15]. In addition, I identified potential participants using the Penn State AgMap, the Cornell South Central New York Agriculture Program Buy Local guide, the Penn State Marcellus Shale Cooperative Extension Team website and the Cornel Cooperative Extension website. A total of 49 participants completed both the Q sort and post-sort interview; two additional participants chose not to complete the Q sort but did complete interviews. Participants included agricultural producers across a range of domains (industrial/non-industrial production; leased/unleased land for natural gas exploration and

[15] Some participants were included who did not live in this seven county region, but who played a significant role in pro- or anti-drilling activism in the region.

development; New York/Pennsylvania location of farm); Cooperative Extension educators at both Cornell and Penn State involved in shale gas education; Cornell and Penn State researchers and faculty members whose research relates to the impacts of shale gas production via hydraulic fracturing in the region; and policy makers at the municipal and county levels in the Twin Tiers region.

In using this purposive sampling strategy, I intended to include a wide range of participants who encompassed diverse positions within the agricultural sector and modes of agricultural practice. In doing so, my goal was to see whether I could identify patterns that illustrate connections between participants' orientations towards shale gas development and how they are situated within rural and agricultural landscapes. Purposive sampling is a widely accepted practice within the standard Q community. According to Watts and Stenner (2012):

> Opportunity sampling is rarely the best strategy…We want to discover relevant viewpoints using Q methodology and that means finding participants who have a defined viewpoint to express and, even more importantly, participants whose viewpoint *matters* in relation to the subject at hand…It is quite usual, therefore, for Q methodologists to operate using a very *strategic* approach to participant recruitment. That means you can legitimately select a participant if you think them likely to express a particularly interesting or pivotal point of view. (pp. 70-1)

However, a critical Q approach views the act of identifying potential participants as an inherently subjective act on the part of the researcher. Researchers can – and should – have a coherent and well-thought-out sampling strategy that articulates with their central research question. Yet, the factors which the researcher, study, and participants ultimately co-produce are inherently connected to *who* the study participants are. While the factors do represent and reproduce facets of the broader Discourse under study, the inclusion or absence of certain individual participants could certainly alter the composition of these factors.

A critical Q approach therefore views the act of selecting and recruiting participants as an important site for querying researcher subjectivity and reflexivity. What assumptions is the

researcher making in their sampling strategy, and how do their decisions shape the study results? Whose perspectives are incorporated, and whose are erased? Just as the concourse and Q set are inevitably partial representations of the universe of statements and opinions about the topic/discourse being analyzed, the participant pool is likewise an incomplete representation of the potential stakeholders and residents involved in (re)producing that Discourse.

As described above, my sampling strategy sought to identify a wide variety of participants who occupied different positions within the agricultural sector, focusing primarily on circulations of agricultural and environmental *knowledge* as opposed to the food system at large. My decision to circumscribe the participant pool in this way was a function of my research sub-questions, which asked what role land grant colleges and Cooperative Extension played in helping farmers understand the risks and benefits of shale gas development. I also sought to include participants across a range of agricultural production practices (e.g. commodity versus diversified production, direct marketing versus regional/national commodity markets, conventional versus organic production, etc.), farm sizes (ranging from 4 acres to 800 acres in size), and experience with shale gas leasing and drilling (leased and had land drilled, leased and no drilling, did not lease but land was drilled, no drilling and no leasing).

While I was able to include some participants across each of these domains, my participant pool did end with fewer participants than I would have liked with larger farms. In particular, I sought out several participants with farms upwards of 1000 acres who never responded to my interview and Q sort requests. Some potential reasons for this include research fatigue (particularly in Pennsylvania's northern tier), lack of time, and lack of interest. On the other hand, it is worth asking whether those participants who did agree to complete a Q sort and

interview were more interested in the topic of shale gas development than their neighbors, and therefore perhaps have more defined and perhaps polarized viewpoints.

4.7.3 Data collection: Q sorts & interviews

For the Q sort, I asked participants to rank-order the 57-item Q set on a forced choice distribution board from "Most Like My View" (+6) to "Most Unlike My View" (-6). The board contained one box for each statement, with two spaces each under the -6 and +6 columns, and more towards the middle in a bell curve pattern (Appendix A.2). In this way, the board forces a normal distribution upon the Q set. I instructed the participants that, at the end of the Q sort, there would need to be one statement within each box, such that none of the spaces would be left empty. Participants often have reactions or make comments when they first read a statement; as a result, I also recorded, transcribed, and coded all Q sort interactions.

The act of completing the Q sort is itself a rich source of data for critical reflection and analysis. For example, I encouraged participants to first do a "rough sort" showing their first impressions of where they would like to place each statement on a forced choice distribution board. I coded and designed the Q set so that the number of statements for each topic and orientation (positive, negative, neutral) were comparable. As a result, I expected participants to have a roughly equivalent number of statements across the spectrum from "Most Like" to "Most Unlike" their views. However, many participants instead rough sorted their statements in a strongly bipolar fashion, creating a reverse bell curve image with a large number of statements under the +6/+5 and -6/-5 columns. Additionally, a majority of participants also had rough sorts weighted towards the "+" (positive) side of the board. Many were reluctant to put statements they agreed with under "-" (negative) columns, despite reassurances that the board was designed to capture their viewpoint along a spectrum, and that the +/- designations on the board were

meaningless for the statistical analysis. Two participants felt so strongly about their original placement that they refused to place each statement in an individual box on the distribution board.[16]

After completing the Q sort, I asked participants to complete a short demographics questionnaire (Appendix A.4) while I recorded their Q sort answers. The questions were open-ended, to avoid imposing *a priori* categories and assumed divisions upon the participants. This approach does result in more detailed responses, although it also presents some complications when later coding participants' answers. For example, to elicit where participants saw themselves on the political spectrum, the questionnaire asked: "How would you describe your political views?" Several participants wrote answers that transgressed what might be considered "typical" political identifications, such as conservative/liberal. For example, multiple participants wrote answers like "moderate/left" or "socially liberal, more conservative financially" which transect political categories. Some answers – for instance, "Politics & even the nation state are outdated" and "need a third party" – resisted efforts to categorize them along a Democrat/Republican or conservative/liberal binary. The questionnaires also asked questions relating to age, race/ethnicity, gender, level of education, occupation, and mineral rights leasing status.

After conducting the questionnaire, I then completed semi-structured interviews with participants to go over their Q sorts and to ask broader questions about their personal experiences with shale gas development and agriculture. I began with a set of defined questions, with different sets for agricultural producers, researchers, and Cooperative Extension educators

[16] This did not preclude their inclusion in the Q sort. Researchers can "force" statements into a normal distribution without undermining the integrity of the statistical analysis (N. Lehrer, personal communication, 13 December 2017).

(Appendix A.5). I also asked questions which had emerged from the Q sorting process at this point. For example, if the participant made a comment or had an unusual reaction to one of the Q set statements, I used that moment as a prompt during the interview. I also used what appeared to be unusual or contradictory placements in the Q sort as interview prompts in order to elicit participants' reasonings for how they patterned the statements. Like the questionnaire prompts, the interview questions were open ended to encourage detailed responses that did not necessarily adhere to pre-determined categories or themes.

4.7.4 Factor analysis & interpretation

After transcribing the Q sort and interview audio recordings, I coded them using *Atlas.ti 8* software. I began with the themes and categories, which emerged from creating the study concourse and Q set, as *a priori* codes (See Section 4.6.1). These codes were expanded and reorganized over multiple successive iterations of coding and analysis between the Q study results, the audio transcriptions, and other included texts such as organizational websites and publications, policy documents, and news media accounts. These results, alongside earlier iterations of discourse analysis, provided additional depth and nuance when interpreting the quantitative Q study results, as outlined below.

To extract shared worldviews, or "factors," from the Q study, I used PQMethod software. I digitally entered each individual Q sort, which were then intercorrelated and put through by-person factor analysis. The software provided many potential solutions, ranging from a two-factor solution to a seven-factor solution. In the final solution, four factors were extracted using centroid factor analysis and rotated with varimax rotation. From the 49 Q sorts included in the study, 40 sorts positively loaded onto one factor at a significance level of 48%. At this significance level, two sorts were confounded, meaning they loaded positively onto more than

one factor; seven sorts were non-significant. Together, the four extracted factors explain 51% of the sample variance, meaning that the four extracted worldviews explain 51 percent of all variance between the viewpoints of all included participants.[17]

There are a number of tests used to establish significance when determining how many factors to extract in a Q study. Factor eigenvalues and factor variances are two fairly simple parameters frequently used by researchers, which give an idea of a potential factor's statistical strength. Generally, eigenvalues over 1.0 and variances over 5 percent are considered statistically sound. Another guideline is to keep only those factors with at least two Q sorts "loading" onto them. However, researchers may wish to include factors that do not meet these criteria for theoretical, epistemological, or ontological reasons. For example, Watts and Stenner (2012) cite a study of deaf children's perceptions of adult classroom helpers, which employs a five factor solution, even though the four factor solution is more statistically robust. They argue that it is appropriate to include the fifth factor, despite being less mathematically robust, due to their determination to highlight as many potential viewpoints as possible for a vulnerable and marginalized group – namely, hearing-impaired children. They argue that relying merely on mathematical criteria is over-simplistic: "For us, the viewpoint itself, our belief in the substantive meaning and significance (or otherwise) of a factor, must always take its place alongside more statistical considerations" (p. 106).

In this study, the mathematical tests outlined above provide conflicting results. Based on the eigenvalue test, there should be at least seven factors – all of the factors extracted through PQ Method, prior to varimax rotation, had eigenvalues over 1.0. However, only the first two factors had variances over 5%. The third test – the number of Q sorts which load onto each factor – also

[17] A robust final factor solution explains at least 35 to 40 percent (Watts and Stenner, 2012).

does not give an entirely straightforward answer. Prior to rotation, three factors have at least two participants affiliated with each; however, one of these factors is "bipolar," with approximately half of the participants positively loading onto the factor and half negatively loading onto it. To make a final decision, I ran the varimax rotation command for six possible factor solutions, ranging from a two factor solution to a seven factor solution. Of these, I chose to use the four factor solution. This solution rotated the factors such that the bipolar factor became two different factors, resulting in four clusters that each had between ten and twenty affiliated participants, and greater than 5 percent variance. Furthermore, this solution included the largest number of participants.

Q sorts which load onto a particular factor do so because the participant sorted the Q set statements in a similar pattern to the other participants associated with that factor. As a result, we can conclude that all Q sorts loading onto the same factor in this study share similar perspectives on the relationship between agricultural production and shale gas development via hydraulic fracturing. The PQMethod software weights and averages together all of the individual Q sorts associated with that shared worldview, creating a composite Q sort for that perspective called the *factor array* (see Appendix B.2 for the factor arrays for this study). The Q sorts which loaded highest onto each factor (such as having a significance level of .75) are weighted more heavily in the average than lower loading Q sorts (e.g. .52), since they are more closely aligned to the "ideal-type" factor array.

As noted earlier in this chapter, many Q method-using researchers call the factors produced through Q "discourses." It is true that the factors, as composites of multiple similar perspectives, do result in aggregate "ideal-type" worldviews. These ideal-type perspectives may draw on broader Discourses to varying degrees; one goal of the analysis and interpretation is to

analyze the relationship between the factors, or "micro-level discourses" identified in this study, and the broader "macro-level" environmental Discourses which shape and influence – but do not necessarily determine – individually held perspectives (Cotton, 2015). Thus, to avoid confusion in the following chapters I will refer to "factors" as the mathematical solutions produced through by-person analysis, and "worldviews" as the perspectives outlined and interpreted within each factor. I use the term "discourse" in the Foucauldian sense, meaning an interconnected system of texts that together (re)produce truth, knowledge, and power in the context of shale gas development and farming.

While each factor represents an ideal-type worldview relating to shale gas and agriculture, the various study participants have varying degrees of similarity in relation to it. The PQMethod software output lists the individual participants with their statistical (dis)similarity with each of the identified factors, called "factor loadings" (Appendix B.1). A level of 1.0 indicates complete agreement with that factor – meaning, placing every statement exactly as it occurs in the composite factor array. Generally speaking, the higher the number, the higher the level of similarity between the individual and the factor. Meanwhile, a similarity level of -1.0 would mean placing every statement in a mirror opposite of the composite factor array, indicating complete disagreement. Thus, negative factor loadings indicate that the individual's Q sort is statistically dissimilar to that factor, with higher numbers indicating higher levels of dissimilarity. To determine which participants are affiliated with each factor, I first calculated a base significance level using an equation outlined in Watts and Stenner (2012).[18] This study, with 57 Q set items, had an original significance level of .37. As a result, any Q sort with a .37 or higher significance level higher could be said to "load onto" that factor. Conversely, any Q sort

[18] To find the level at which factor loadings are considered significant, Watts and Stenner (2012) use the following equation: 2.58 x (1√no. of items in Q set).

loading at .36 or less is not statistically robust enough to load onto that factor because it does not share a high enough level of similarity.

At the original significance level of .37, only one Q sort did not significantly load onto any of the four identified factors. However, 14 sorts were "confounded," meaning they loaded significantly onto more than one factor. Raising the significance level to .48 captured 12 of the original confounded Q sorts, leaving only two confounded, but increased the number of the insignificant Q sorts to seven. At the .45 significance level, it would have been possible to retain three of those seven insignificant Q sorts, but at the expense of leaving three of the confounded Q sorts uncaptured. As a result, the same number of Q sorts would be included in the final factor loadings at either the .45 or .48 significance level. I chose to apply the higher significance level, since that would capture the participants who loaded more highly onto each, and therefore had a higher degree of similarity to the aggregate factor array. This results in a cleaner ideal-type factor array for each of the captured worldviews.

The presence of confounded factors presents a valuable illustration of the complex nature of the debate over shale gas development as it relates to farming. While each factor represents an idealized worldview shared by several people, human perspectives do not necessarily fit so neatly into such easily defined boxes. In other words, while this analysis identifies four primary viewpoints within the debate over shale gas development and agricultural production, these perspectives are not the only ways of viewing this topic. Furthermore, confounded sorts highlight how individual participants may draw on multiple and potentially contradictory opinions, values, and beliefs which inform their worldviews. Thus, confounded Q sorts may actually help point researchers to key areas of interest by highlighting topics or domains where contradictions, conflicts, and silences occur, and tracing them to the broader Discourses which shape them.

The factor arrays provide the foundation for analyzing each factor. Interpreting the Q study results is a process of holistically examining all of the statements within the factor array: how they relate to one another and other factor arrays, and how they relate to macro-level discursive themes and categories produced through multiple, iterative stages of discourse analysis. The purpose of interpreting the factors is to explain, in as comprehensive a sense as possible, the worldviews encapsulated by the factor arrays and how they are produced through broader Discourses around shale gas development and agricultural production.

In the next chapter, I present the descriptions of each factor as full narrative interpretations. I include the rankings for relevant Q sort items in these narrative descriptions. For example, (1: +3) indicates that item 1 was placed in the +3 column for that factor array. Please reference the appendix (Appendix B.3) for a complete table of the statements and their rankings for each included factor. The narrative descriptions also include quotations taken from the semi-structured interviews and Q sort process, in order to supplement the factor interpretations with additional detail and nuance.

4.8 Conclusion

As this chapter argues, previous Q studies in human geography have done relatively little to explicitly engage critical discourse analysis. This is a significant gap, given that Q is primarily employed to measure how different participants align within and relate to complex discourses. c*ritical Q* addresses this limitation by using critical discourse analysis to make Q more attentive to the uneven power relations which (re)produce complex discourses. As many of the studies cited here illustrate, human geography is already the disciplinary home of a promising body of critical Q scholarship. Human geography is uniquely situated to continue developing a broader body of critical Q research by integrating Q methodology with critical social theory.

This chapter also outlines how my dissertation employs a critical Q framework throughout the stages of study design, deployment, and analysis. In so doing, I aim both to articulate a theoretical foundation for critical Q, and to provide a detailed case study demonstrating its use and utility. The following chapters each highlight a different facet of how critical Q provides useful insights into the intersections of shale gas development and agricultural production, with Chapter 5 first providing in-depth narrative interpretations of each factor.

CHAPTER 5

Q STUDY RESULTS

5.1 Introduction

As described in Chapter 4, interpreting each factor is a process of holistically examining all of the statements within the factor array and how they relate to each other, as well as how those patterns relate to the patterns within the other factors produced in the study. My purpose in this chapter is to interpret the four factor arrays, which I view as inevitably partial and incomplete representations of study participants' shared perspectives. I wish to emphasize that each factor comprises a simplified average of many heterogeneous worldviews. Each factor therefore represents an idealized worldview that is shared to some degree by the participants who significantly load onto that factor; higher factor loadings (Appendix B.1) indicate a higher degree of similarity between the idealized perspective presented here and individual participants' viewpoints. While I use quotations from individual participants that illustrate the sanitized worldview represented in these narrative interpretations, I also include their factor loadings to give a sense of their overall similarity to the shared perspective within that factor.

While the factor arrays (Appendix B.2) provide the foundation for each interpretation, I present the descriptions of each factor here as a full narrative interpretation. I include rankings for relevant Q sort statements in the narrative descriptions. For example, (19: +4) specifies that statement 19 was placed in the +4 column of that factor array. I also note distinguishing statements for each factor, meaning those statements that a factor sorts in a significantly different way than any other factor. An asterisk (e.g. *19: +4) indicates a distinguishing statement at

p<.01, and a dagger (e.g. †19: +4) denotes a distinguishing statement at p<.05. A complete table of the statements and their rankings for each factor is available in the appendix (Appendix B.3). I also include data from the demographics questionnaire (Table 5.1) and quotations from semi-structured interviews conducted after each Q sort to supplement and add nuance to the factor interpretations, although the demographic data is discussed in more detail in Chapter 6.

Table 5.1: Participant demographics by factor

Characteristics	**F1 Balanced rationalists**	**F2 Environmental protectionists**	**F3 Extraction enthusiasts**	**F4 Skeptical individualists**
n	11 participants 11 Q sorts	14 participants 13 Q sorts	11 participants 9 Q sorts	7 participants 7 Q sorts
Eigenvalue	12.48	9.15	1.93	1.79
Study variance	15%	16%	11%	9%
Gender	8 male 3 female	6 male 8 female	9 male 2 female	7 male
Race/Ethnicity	11 white	14 white	9 white 1 "American" 1 "Italian-American"	6 white 1 "American"
Age	Average: 53.7 Range: 41 – 63	Average: 54.8 Range: 29 – 75	Average: 62.3 Range: 54 – 68	Average: 52 Range: 37 – 62
Location	3 New York 8 Pennsylvania	11 New York 3 Pennsylvania	9 New York 2 Pennsylvania	3 New York 4 Pennsylvania
Education (highest level completed)	4 Bachelor 4 Master 3 Ph.D.	5 high school 5 Bachelor 2 Master 2 Ph.D.	4 high school 5 Bachelor 2 Master	3 high school 2 Bachelor 2 Master
Profession	6 Cooperative Extension 2 academic faculty 2 policymakers 1 farmer	10 farmers 2 academic faculty 1 environmental NGO*	10 farmers 3 policymakers†	7 farmers
Political orientation	5 liberal 2 moderate 2 conservative 2 "socially L, fiscally R"	8 liberal 3 moderate 1 libertarian 1 "anti-capitalist" 1 "need a third party"	9 conservative 1 moderate 1 "fiscally L, socially R"	3 conservative 2 libertarian 1 "radically conservative" 1 "the nation state is outdated"

*The participant currently employed at an environmental NGO had previously been employed through Cooperative Extension.
†Two policymakers in this factor was also a farmer.

In this chapter, my goal is to provide an in-depth narrative representation of each worldview as it relates to shale gas development, agriculture, and knowledge. These long-form narratives follow Q analysis conventions as described in Watts and Stenner (2012), with theoretical analysis following in Chapters 6 and 7. After the narrative interpretations, I conclude the chapter with a discussion of what patterns of convergence and divergence emerge when the different factors and their interpretations are compared.

5.2 Factor 1: Balanced rationalists – *"We need to look at the big picture"*

Balanced rationalists see themselves as an objective and neutral third party in the shale gas debate. Like all sources of energy, they view shale gas development via hydraulic fracturing as having a mixture of costs and benefits, which formed a prominent theme among the participants:

> There's a whole set of bads that come along with the good and how do you balance those, which is the same whether you're talking oil and gas or whether you're talking wind farms, hydroelectric. There's all pros and cons, and you either focus on the pros or you focus on the cons and you don't really talk about either. (Cooperative Extension educator, Pennsylvania, F1 = 0.67)

As this quotation illustrates, examining shale gas development in the context of the "big energy picture" (county planner, New York, F1 = 0.71) is a prominent theme among rationalists. This idea comes strongly to the fore when discussing the statement "Shale gas can act as a bridge fuel to renewable energy" (52: +2) – a claim which rationalists are hesitant to wholeheartedly endorse, although they view climate change as a significant environmental concern (2: +2). Yet, rationalists acknowledge that natural gas is preferable in some respects to oil and coal. Referring to statement 52, another participant said, "I hate that language," explaining:

> As a global citizen, I see some climate change benefits from doing natural gas. Is it a perfect climate change solution? Absolutely not. It is still a fossil fuel, and it still takes a lot of energy to get that fuel out of the ground…Is it a true bridge? No. It just buys us time to figure out how to do it better. Are we actually doing that? No. (laughs) So again,

> it's the how. To me it's not in and of itself an inherent good or evil, it's how we set up our system to do it right. (land grant college researcher, Pennsylvania, F1 = 0.59)

As this passage indicates, when looking at the broader energy system, balanced rationalists believe that shale gas can and should be part of a diverse energy portfolio, and that focusing entirely on any single energy could be harmful. Stemming from their focus on shale gas as part of a bigger energy system, supporters are highly skeptical of any claims which portray hydraulic fracturing as entirely beneficial or detrimental (*24: +6, 55: +5). As one rationalist noted, "There clearly are some strong positives of gas development. There clearly are some strong negatives. And I think the challenge for us in policy and in society is how do we balance these" (land grant college researcher, Pennsylvania, F1 = 0.63). In terms of positive impacts on the agricultural sector, balanced rationalists are vocal in their belief that many farmers have greatly benefited economically from shale gas development. According to one participant, "Farmers by and large reinvested [their lease income]. They put it into their farms. They fixed up their homes, their barns, they bought new equipment or fixed up existing equipment or they improved what they had. It's kept them afloat, they're farming with money instead of for money" (Cooperative Extension educator, Pennsylvania, F1 = 0.67). Thus, rationalists are hesitant to underplay the positive impacts lease income has had for members of the agricultural community:

Yet, balanced rationalists are hesitant to endorse the industry-circulated claim that shale gas development "saves family farms" (*6: +1; 32: -2), even though they agree that farmers in the Twin Tiers region are struggling financially (10: +3). As one participant put it, "We need to make sure that we're not singularly focused on the industry as the salvation for economic development for rural communities in the Marcellus shale" (county commissioner, Pennsylvania,

F1 = 0.58). Rather, rationalists view the influx of shale gas money to the region against the broader context of a struggling agricultural sector:

> P: I mean, unfortunately I have a very pessimistic view of the viability of agriculture, period. I'm sure that the big farms are going to continue to become bigger, and small farms just can't compete with that.
>
> I: Yeah. Do you think that the shale gas industry has helped with this in any way?
>
> P: Well, I think it's enabled some people that want to stay in farming to be able to do it even though it's not profitable. So in a way, yes, I guess they have helped it.
>
> I: Do you think that's a long term solution?
>
> P: No, not really. I think it makes it so that they can – It's like the old joke, you know, about the farmer that wins the lottery, wins $2M and they ask him what are you going to do with your new found money? Oh, I'm going to farm until it's gone. (laughs) (grass-based livestock farmer, Pennsylvania, F1 = 0.56)

Thus, unlike what they see as the more dogmatic views of some pro-drilling advocates, balanced rationalists do not view shale gas development as a panacea for addressing long-term trends of rural disinvestment, or for fixing structural changes in the agricultural industry. As another rationalist noted, "At the end of the day, we haven't done anything on stabilizing milk and dairy prices…The future of agriculture in this county has less to do, in my opinion, with natural gas than it does with having an agricultural system in the country that supports the types of farms that we're talking about" (county commissioner, Pennsylvania, F1 = 0.58). As these observations indicate, rationalist believe that the economic benefits of shale gas development will not have sustained impacts without systemic changes to the region's underlying economic framework.

Balanced rationalists claim that the potential benefits of shale gas development are unevenly distributed; they also see its potential costs in the same light. Thus, they seek to distance themselves from assertions that the negative impacts of shale gas extraction are inevitable or systemic (5: -1; 8: -4; 26: -2; 27: -1; 53: +6). For instance, rationalists frequently highlight the "boom and bust" dynamics shaping shale gas development, which can limit both its

positive and negative impacts. According to one participant, "The peak of activity or the temporal nature of the activity affects what the impacts are locally…And so with this kind of development, especially in any one individual community, there is an increase and decrease dynamic. It's not forever and ever" (land grant college researcher, Pennsylvania, F1 = 0.63). Several participants note that many negative impacts – including increased traffic, influxes of out-of-state workers, rises in crime, increased pressure on municipal services and infrastructure, and lack of hotel space or affordable housing – were at their worst in Pennsylvania from 2008 to 2012, the most acute period of development when gas prices were high. As a result, they are disinclined to view many costs of shale gas development as permanent, although they do acknowledge that certain impacts, particularly environmental contamination and degradation, can be more long-term.

That said, balanced rationalists believe it is possible for food and natural gas production to co-exist without issues (1: +2, 7: -1). While they see a need for more research on the relationship between gas drilling and farming (19: +3), they also believe there is sufficient evidence regarding the long-term effects of hydraulic fracturing to justify continuing shale gas development in the region (54: -3). That said, rationalists view the process as presenting unique challenges to the agricultural sector, largely by impacting ancillary systems such as availability of key inputs or transportation. For example, one rationalist explained, "In Pennsylvania there's a number of farmers that lost their labor to this industry…[which] can pay a lot more than we can as a farming community" (Cooperative Extension educator, Pennsylvania, F1 = 0.60). Other rationalists cited issues such as removing or losing topsoil (which takes years to build up), taking valuable land out of production, and managing the placement of roads, pipelines, and other drilling infrastructure. In part, balanced rationalists' perspectives on this topic comes from

viewing agriculture as itself an extractive industry, with shale gas drilling as a recent introduction to what was already an industrial working landscape (28: -4; 45: +6). They are the least likely of all four factors to have an exceptionalist view of farming as inherently involving environmental stewardship (11: +3), foundational to an American way of life (*57: 0), or of farming landscapes as fundamentally "bucolic" or "pristine". Rather, many rationalists argue that agricultural production itself frequently causes environmental degradation.

Despite the potential for some negative impacts, balanced rationalists take issue with what they see as extreme depictions of total environmental devastation by some anti-drilling advocates, which they view as ignorant or misinformed. For example, one rationalist, speaking to the widely-publicized fear that chemicals in hydro-fracking fluid could migrate up from shale to contaminate regional groundwater sources, believed this claim was rooted in a basic misunderstanding of geology and the drilling process:

> You know, a lot of the concern over the chemicals is driven by fear of what those chemicals do and the quantities and how they're handled, which are all valid concerns, but what's not included is the perspective of exposure and the exposure pathways and the risk, because unless you're doing something you shouldn't, you're never going to be exposed to those chemicals. And there's a fundamental misunderstanding of the whole process. (Cooperative Extension educator, Susquehanna County, Pennsylvania, F1 = 0.67)

Although balanced rationalists say that environmental contamination can and does occur, they diverge with anti-drilling narratives by viewing these issues as the exception, rather than the norm. As one participant explained, "Most water issues are very localized in that if I contaminate a well here, you're not going to have an effect five miles from here…The notion that we have entire areas or regions of the state that the water has been tainted…has not come to play, should not ever come to play, but we still have a localized issue, and that's very important if you happen to be the person being affected" (Cooperative Extension educator, Pennsylvania, F1 = 0.72).

Together, these examples illustrate that balanced rationalists see a role for shale gas development as part of the U.S. energy landscape, and are firmly against any suggestion that it should be banned (42: -6). However, they do view the process as potentially dangerous (20: -5, 36: -5), and see a need for strong state regulations to mitigate potential costs (40: +5; 41: -4; 38: +1; 37: -1). As one rationalist explained, "Regulations are protective. Regulations even the playing field" (Cooperative Extension educator, Pennsylvania, F1 = 0.59). That said, most rationalists believe current oil and gas regulations in Pennsylvania are strong and effective (39: -3), although they acknowledge some room for improvement:

> I know here in Pennsylvania that we have – there's always room for improvement, so I'm not saying that our regulations are perfect, but when it comes to things like spill prevention and control or reportable spills, we have among the strictest regulations in the country. (Cooperative Extension educator, Pennsylvania, F1 = 0.62)

Relatedly, balanced rationalists do not necessarily trust the oil and gas industry to adequately regulate themselves, and are somewhat ambivalent about the oil and gas industry as a whole (33: -2; 21: +1; 23: +1). For instance, one rationalist argued, "Shale is safer now, in many ways it is, but that happened largely because of regulation and public pressure, it wasn't something that they just technologically improved. They were forced" (Cooperative Extension educator, Pennsylvania, F1 = 0.59). However, they do see a need to involve industry stakeholders in the regulatory process, and acknowledge that the relationship between policymakers and industry can work both ways:

> It's interesting, we see sometimes industries' best management practices change and then regulations follow them, in other cases we see regulations proposed that then change the best management practices of companies…meaning sometimes industry won't see the right path so to speak because it's against them economically or whatever, so they might be more reluctant to make a change, so then regulation pushes them into a different direction. Other times, again, the technology changes and it's to the industry's favor to make that change, and then regulations come along or the regulator says hey, you know, we should make that a regulation so that everybody has to do it, not just the top five of the ten companies, everybody should do that, so we've seen that happen as well. (Cooperative Extension educator, Pennsylvania, F1 = 0.60)

Similarly, balanced rationalists hold nuanced views about environmentalist groups and NGOs (29: 0;*47: -1), who they view as circulating a mixture of well-informed, biased, and politically-motivated information. As a result, in the early days of the shale boom, all information coming from environmentalist and industry sources was carefully researched, as one rationalist explained:

> It felt like I had to fact check everything that was happening, so I couldn't believe anything from anybody. I had to go back to the root source of the material, whether it was a research project from another university or even our own university, or information from environmental groups or information from industry, it didn't matter. You had to always go back, in my opinion, and find out what was the context of the information, was the whole story being told, was the information accurate, did they do the calculations correctly. (Cooperative Extension educator, Pennsylvania, F1 = 0.62)

This last quote gestures to the role that cautious supporters see themselves as fulfilling within the shale gas debate: that of impartial experts who produce, vet, circulate, and apply credible information and knowledge within their community (34: +3; 46: +3; 48: -3). Eight out of eleven participants in this factor are employed through Cooperative Extension as extension educators, or as faculty members who previously held extension appointments. Thus, it is no surprise that, of all the factors, balanced rationalists are the most likely to see Cooperative Extension as performing an important role in educating the public – not limited just to farmer-landowners – on timely topics impacting their communities (*16: +4; 22: -2; 34: +3). Two of the remaining members work as municipal policymakers – one as a county planner, and one as a county commissioner. A prominent theme among rationalists was therefore the need to maintain a neutral, objective perspective as key knowledge producers, communicators, and users in the face of divisive polarization, as one participant summarized: "I think we've been recognized by some in particular in the legislature who say, hey, you guys are doing a great job. You're the only ones kind of presenting this center view, if it is a center view. It's more central than any

other organization seems to be doing anyway" (Cooperative Extension educator, Pennsylvania, F1 = 0.72).

As this statement illustrates, balanced rationalists tend to believe that researchers and Cooperative Extension professionals should avoid prescribing particular actions, regardless of their personal opinion. Rather, they see their role as portraying the current state of scientific knowledge. A one rationalist explained, "Throughout, kind of my approach was trying to – it was to be neutral, unbiased in the meetings…What I care about is you understand what it is. And then if you like what you understand, great. If you don't like what you understand, that's great. I'm not here to argue for or against, just to help you understand what it is" (Cooperative Extension educator, Pennsylvania, F1 = 0.63). For those employed as policymakers, participants shifted from viewing their role as communicating unbiased information to the identification and application of credible scientific knowledge. One municipal policymaker described how this stance shaped her efforts to make well-informed regulatory decisions:

> There was a study that came out about radiation, and we were looking at that, and – because people were concerned about we were going to take drilling waste at our landfill, that was going to be highly radioactive…But we're looking at that study, and…the way it was being interpreted, and we're like this just doesn't add up, and then reading all the peer reviews of that study and finding people saying that that particular scientist was walking the line of being completely unethical in how he was reporting out his data…So we spent a lot of time reading, studying, discussing, trying to get information. (county planner, New York, F1 = 0.71)

Balanced rationalists believe attempting to hold an unbiased position is necessary when navigating the highly divisive and politicized shale gas debate. As highly-educated experts, rationalists see themselves as the best source for accessing up-to-date, rigorous, and credible information when it comes to shale gas development, and view being perceived as providers of accurate scientific information as crucial given the prevalence of incorrect information circulated by different stakeholders. Although rationalists strive to maintain an objective stance, many

participants see a need for critical reflexivity, both for their own research as well as when evaluating other sources of information. As one supporter explained, "I don't believe in neutral science…it serves interests, and that we all need to be critically aware – aware and critical of how we do that. But I also believe that there's bad science and, you know, well-done work that is open, particularly, to being shown wrong" (Cooperative Extension educator, New York, F1 = 0.62).

Unsurprisingly, balanced rationalists are somewhat skeptical when it comes to anecdotal evidence of contamination from shale gas drilling (18: 0), which they contrast unfavorably with their own expertise. On the whole, rationalists disagree with what they saw as fear-driven arguments against shale gas development and its impact on food systems, such as contentions that shale gas development on farms makes that food unsafe (3: -6) or that it would make organic farmers lose their certification (9: -2)[19]. Descriptions used by rationalists included "red herrings," "misinformation," "anti-science," and "political". This theme is particularly prevalent throughout cautious supporters' discussions regarding statement 55 ("I think pro- and anti-drilling groups are both guilty of misrepresenting science to suit their arguments"), which the factor ranks at +6. One rationalist contrasted the work of pro- and anti-drilling interest groups against that of land grant universities and their associated Cooperative Extension programs:

> I think that there's a public that is lining up around science that suits their political views or suits their philosophical leanings, and I think different groups, whether they're pro or anti are putting information out there…whether you want to call it science or opinion statements or whatever it might be, but it rallies the troops on one side of the argument or the other, and that really bothers me…We try to be advocates of science… but there are

[19] Similar to their moderate stance on shale gas development, cautious supporters see both benefits and drawbacks associated with conventional and organic/sustainable agricultural production techniques. They view sustainable production as environmentally preferable (15: +4), and argue for the need to protect groundwater from contamination (25: +5). However, they are more neutral on statements that organic/sustainable agriculture can "feed the world" (14: 0) or provide sufficient economic viability for struggling farmers (12: +1). They see a continued role for conventional farming practices in the agricultural economy, and view affordable domestic energy as foundational to the success of conventional practices (13: +2; 31: +2) – though they are less likely to endorse conventional production techniques than members of Factor 3, extraction enthusiasts.

> entities that are putting out information that I'm not sure is truly non-biased, middle of the story, here's the facts, nothing more, and that is troublesome. (Cooperative Extension educator, Pennsylvania, F1 = 0.60)

As this final statement illustrates, balanced rationalists are firm in their belief that interest groups within divisive debates such as that over shale gas development would benefit from paying attention to what the "science" tells us. As professionals trained in science production, analysis, and communication, rationalists see themselves as the most qualified group to provide that information to key stakeholders in the region. Balanced rationalists – including those who acknowledged being having a personal anti-drilling preference – argue that the scientific literature does not support a total ban on shale gas development, particularly given the complexity of the topic and the "big picture" of energy and agricultural systems in the U.S – a distinct contrast to the perspective held by the next factor, the environmental advocates.

5.3 Factor 2: Environmental protectionists – *"Fracking must be completely banned"*

Of all the factors in this study, environmental protectionists are the most concerned with safeguarding natural resources. For example, they are the factor most likely to agree that farmers need to be leaders on addressing climate change (2: +3). As a result, most protectionists define their environmental practice as attempting to establish a balanced relationship with the natural world, rather than attempting to control it:

> It was always important to me to have a relationship with my land base or with the environment…I firmly believe that as humans, as beings on this earth, we are not above the laws of nature… Part of what guides me or part of what I really value is living a life that does not disrespect or degrade nature, and trying to be aware of that connection of how we are part of this planet. We are not exempt or above respecting it. (permaculturist produce farmer, New York, F2 = 0.74)

For the farmers who comprise the majority of this factor, this attitude directly informs their agricultural practice. Environmental protectionists strongly adhere to the view that so-called

"alternative" agricultural production methods[20] are necessary to sustain long-term environmental, economic, and societal well-being (11: +4; 12: +3; 14: -2; 15: +6). As one advocate who attended college in the 1960s explained, "I have a degree in agriculture from the University of Massachusetts, it was during the time when factory farming, commercial agriculture was really turning that corner into gi-gondo industrial farms. And I decided I could never work in that sector, I just couldn't put that together with my feelings" (horse boarder, New York, F2 = 0.82).

Environmental protectionists define "good" farming practices as a combination of sustainable environmental stewardship with a strong collectivist ethos that prioritizes social embeddedness within their local community. Protectionists strongly believe the good of all should come before the good of the individual – a perspective articulated by many participants as one reason for their approach to sustainable environmental practice. For instance, one protectionist stated, "I think as stewards of the land, we have an obligation to protect our lake, to protect our neighbors…We need to keep the land healthy and sustainable for our future generations" (vineyard farmer, New York, F2 = 0.72). Prioritizing and strengthening social ties between their business and community is a further key expression of their collectivist outlook. In one case, a participant contrasted his efforts to market a CSA within his home county to some of the larger CSAs in the area, explaining:

> They drive to Rochester and Buffalo for their members. I want no part of that. That's defeating the purpose. Like I'm growing the food here for the people here who need it…I wanted to live in a world where I didn't have to drive hours upon hours to distribute food, and again, this is a poor area. You know, poor people are the sickest, the people who need it most. I wanted to serve them. (permaculturist produce farmer, New York, F2 = 0.74).

[20] Meaning some combination of organic, permaculture, naturally grown biodynamic, or animal welfare certification; local production and distribution; direct marketing to consumers through farmers markets, locally owned businesses, on-farm sales, agro-tourism, or community supported agriculture (CSA); and/or small-scale production.

Environmental participants see shale gas development via hydraulic fracturing, which they call "fracking," as a pressing environmental issue (*53: -3; 20: -6), and view it as antithetical to their values and norms of environmental and social sustainability. One participant, who was visibly and audibly emotional, called fracking "the rape of my land" (horse boarder, New York, F2 = 0.82). While individual participants differ somewhat on the degree of harm ultimately caused by the practice, they agree the evidence clearly shows that fracking is environmentally detrimental in the long run (54: -3). As a result, most protectionists view the risks presented by fracking as so worrisome that they do not see any potential for safe shale gas development (*23: -4; 36: -5; *51: -3).

While there is some variability among participants in the factor, environmental protectionists as a whole believe that fracking should be completely banned (*42: +5) – a statement which they rated much higher than any other factor.[21] As one New York-based activist and farmer explained, "I think that fossil fuel companies are basically the most evil forces on the planet right now, and that stopping fossil fuel extraction in New York state is just one piece of the puzzle in whatever hope we have left to mitigate climate change" (organic orchardist, New York, F2 = 0.66). While somewhat supportive of enacting a tax or fee on natural gas development (†40: +2), protectionists view current regulations as insufficient, and are overall suspicious of any policy that does not advance a total ban on all shale gas development-related activity (38: +2; 39: +1; †41: -2; 42: +5).

Overall, environmental protectionists view the negative externalities of fracking as systemic and inevitable, although its effects might not be immediately observable. One protectionists stated, "It's not a question of when those well casings will fail. They will fail. And

[21] The other three factors all rated this statement at -6.

they may not fail the first year. They may not fail the second year. But you can be darn sure, the way the earth is, and the way material science is…none of those well casings are going to maintain their integrity over the long haul" (environmental NGO employee, New York, F2 = 0.79). One prominent theme among this group is the issue of how fracking can compete for and ruin agricultural resources like water, air, and soil (*1: -5; *7: +3; *9: +1; 25: +6), and thereby result in public health risks (3: 0; *4: +5). In particular, protectionists frequently highlight concerns over water contamination via methane migration or hydro-fracking chemicals. The question of water quality is especially concerning to farmers in the area; as one participant living in Pennsylvania stated, "It just concerns me that this fracking is hanging over my head, and if my water gets ruined, everything's gone" (non-organic homesteader, Pennsylvania, F2 = 0.70). Nearly every protectionist brought up the issue of water contamination in their interview. The following passage provides a representative example:

> I think our view is also that on top of the damage it would have done to the farm, there's always that chance, no matter how small, that the seal fails on the bedrock, and the northeast is like the Saudi Arabia of fresh water. Twenty percent of the water and the fresh water in the world is here on the Great Lakes. And water's going to be a big thing going into the future. I'm like, well, this seems like a poor judgment to be doing this. (organic diversified livestock farmers, New York, F2 = 0.62)

In addition to water quality concerns, several environmental protectionists cited air quality and greenhouse gas emissions as a serious issue., citing research from a series of papers from researchers at Cornell which estimated high methane leakage throughout the shale gas development process. The least likely factor to agree with the claim that natural gas can act as a "bridge fuel" towards renewable energy (54: -3), multiple protectionists expressed concern about the potential for shale gas development to exacerbate climate change:

> We were not supposed to be on a bridge, we're supposed to be on an exit ramp. You can't use fossil fuels to bridge over fossil fuels…We're trying to bridge over fossil fuels and the greenhouse gas emissions. So you do that by burning more fossil fuels? The counter argument is, oh but it's not necessarily a bridge, it's just a lesser evil, because if we didn't

> burn natural gas we'd burn more coal, and obviously coal is worse than natural gas. But no it isn't. From a point of view of climate change, natural gas is the worst fossil fuel… So again, all you wind up doing is elongating the fossil fuel era, and burning more fossil fuels. (land grant college researcher, New York, F2 = 0.75)

Of all factors, environmental protectionists are the likeliest to see shale gas development as a serious perturbation to the region's agricultural landscape and community (*28: +2; *44: 0; †30: +1). Many protectionists expressed concern that fracking could destroy their farming business, whether by contaminating the soil, taking up productive land, or ruining their farm's reputation. According to one participant who experienced conventional drilling on her farm, "To this day there's shards of the landscape fabric half buried in the dirt that you can't really get out, flapping around in the wind, and they didn't take all of the cobbles out, and then in the areas they took the cobbles out, they took feet of top soil, and they were carting away the topsoil in dump trucks" (organic orchardist, New York, F2 = 0.66). Several participants also explained that their direct-marketing business model could be threatened by customers' fears of contamination. One protectionist whose family runs a multi-generational vineyard worried that fracking could destroy agritourism in the region, saying, "This family farm has spent decades and decades and decades building the Finger Lakes brand, and we are now world-renowned. We have worked so hard to have this reputation, finally, as a premier wine region. How does that even mix with industrialization and gas?" (vineyard farmer, New York, F2 = 0.72).

Given their concerns over the potential for fracking to negatively impact their livelihood, it is no surprise that environmental protectionists view shale gas development as detrimental to economic wellbeing (*8: +4; *26: +2; *27: +3). They strongly negate claims that shale gas development has economically benefited the region's farmers or economy as a whole (*6: -5; *32: -3). As one participant argued, "If you factor in public health, and if you factor in unknown problems down the road with degrading cement and steel and water contamination, if you factor

that into the economic equation there's no benefit…Look at all the coal communities. There was no long-term benefit to them" (diversified perennial crop farmer, Pennsylvania, F2 = 0.76). In fact, protectionists are the least likely of all factors to view small family farmers as struggling economically (10: +2), or to agree that farmers need fossil fuels to operate profitably (13: -1; 31: +1). One illustrative quote from a protectionist demonstrates their perceived connection between alternative agricultural practice and economic stability:

> There's a part of me that understands that poverty, because there's a lot of it in farming. But when I say to my neighbors, you have the land, you have the equipment, you have the work ethic, and you have the information. I can come up with a list of alternative ways for making a living off of your land, and to a man, they say to me, but, but I'm a dairy farmer. But I grow corn. I've never heard anybody say, oh, really? Do you think there'd be a market if I put that ten acres into you pick blueberries, or if I were to switch from dairy to raising organic beef? You think I could sell that? Nobody's ever said that to me, oh, no, why would I ever do that? I really think that instead of wishing for the lottery ticket, [they should] try and think outside the box. (horse boarder, New York, F2 = 0.82)

Environmental protectionists contrast their concern over the potential for collective harm with what they see as the individualist focus of pro-gas stakeholders, who they view as focused primarily on their own economic gain at the expense of the environment and society as a whole. The juxtaposition between collective protection and individual gain is a prominent theme among participants in this factor, as the following representative passage illustrates:

> It's all about making the money and to me, it's far deeper than that. I mean, you could give me a couple million dollars and it wouldn't give me water back. You're talking about a lifetime of never having – a piece of land ever having water…You can't put money on that. And you know, people around here have disappointed me in that the money seems to be far more important. (organic dairy farmer, Pennsylvania, F2 = 0.61)

Similarly, protectionists view the natural gas industry as putting the pursuit of profit above environmental and societal well-being. Overall, protectionists are deeply distrustful of the natural gas industry, and tend not to believe any information from industry sources (*21: +5; *33: -6). As one participant explained, "I've been involved in a lot of lawsuits where…people's water would become unusable, people got sick, people's property values declined, all kinds of bad

things happened…of course the industry position was, and still is, we didn't do it. It's a pure coincidence. Over and over and over and over. And it defies belief" (land grant college researcher, New York, F2 = 0.75).

While not quite as distrustful of land grant colleges and Cooperative Extension Service (CES) as they are of the oil and gas industry, environmental protectionists are the likeliest of all factors to view these institutions as biased towards shale gas interests (*48: 0). They also disagree that CES plays an important role in educating farmers on fracking or otherwise (22: -1; 34: -1; 16: 0) – particularly so in Pennsylvania, although many New York-based participants feel similarly towards Cornell. While some participants expressed the view that CES did a good job of staying neutral in the shale gas debate, the majority of protectionists interpreted CES' neutrality as grossly underplaying the risks of fracking. As one participant recalled, "They would hold these meetings, these landowner education meetings, and it was like a friggin' cheerleading – like a facilitation for signing a lease. They played a huge, huge role in getting a lot of land signed up in our area" (organic orchardist, New York, F2 = 0.66). Protectionists interpret this perceived bias as connected to the CES focus on larger farms which use industrial production methods, as one participant explained:

> P: A large part of their base is among traditional farmers they seemed very reluctant to want to alienate.
>
> I: And what do you mean by traditional?
>
> P: You know, they were not organic small farms…I mean, they're a great source of education for large-scale commercial farmers. And as a land grant institution, they are beholden to some of the larger ag interests. The dean at the time of the ag school came from a really huge farming family in Batavia [town in western New York], where there's been a lot of gas drilling. (environmental NGO employee, New York, F2 = 0.79)

Similar to their stances towards CES and the natural gas industry, environmental protectionists tend to view government institutions – such as the EPA at the federal level or the

Pennsylvania Department of Protection (DEP) at the state level – as "beholden to corporate interests" (organic orchardist and anti-drilling activist, New York, F2 = 0.6644). As a result, participants in this group do not tend to implicitly trust information from those sources (50: -1). In some cases, protectionists even suspect government entities of actively suppressing or erasing pertinent information:

> We had a situation where our neighbors' Trenton Black River[22] well…the Department of Energy permitted Fortuna [energy company] to do a test, because they were going to use it as a waste disposal well for fracking fluids. And the whole thing was secret. And we had to FOIA [Freedom of Information Act] the test results and meanwhile they're like, why are you such a whacko. This is totally safe. I'm the Department of Energy. (laughs) Like trust me. But I won't tell you the results, you know? (organic orchardist, New York, F2 = 0.66)

This perspective – in which environmental protectionists see government stakeholders as seeking to further industry interests – exists on a spectrum within this group, and appears to align somewhat with individual participants' political views. Some individuals, who described their viewpoints as anarchist and/or libertarian, expressed their belief that the corrupt government system is actively suppressing citizen's rights through covert action:

> P: You've heard of false flags.
>
> I: False flags? I don't know if I'm – tell me what you mean.
>
> P: That could be like Waco, it could be like 9/11, it could be like Sandy Hook. It could be like this Las Vegas shooting. I mean, somehow this stuff happens, and who is behind it? Who orchestrates this stuff?
>
> I: Mhm. You think it's the government or like somehow related to that? People in the –
>
> P: The corporations are running the government…And the governments, they're all getting money from the corporations. I mean, it's just one big mess, and how we get it stopped, I don't know. (non-organic diversified homesteader, Pennsylvania, F2 = 0.70)

[22] A dolomite limestone formation located deeper than the Marcellus shale formation. There has been vertical drilling for gas in the Trenton-Black River formation in parts of New York near the Finger Lakes, particularly in Steuben County.

While this specific view is not shared by all the participants in this factor, it does represent a line of thought that is present within the broader environmental protectionist worldview, and should be acknowledged. While the majority of individual protectionists might not claim that the U.S. government orchestrates mass shootings, they do as a whole believe that the federal government knows hydro-fracking chemicals are harmful for human health, but chooses not ban them due to corporate lobbying (36: -5). Thus, while the severity of their distrust towards government varies among individual participants, the distrust itself is a common factor.

In terms of where environmental protectionists do get information that they find credible, they are the group most likely to trust information from environmental organizations and left-leaning media sources (*35: -2; *47: -3). Many protectionists are involved in, or cited information from, regional anti-fracking groups such as Shale Shock Alliance, FracTracker, the League of Women Voters, Dryden Resource Awareness Coalition, the Community Environmental Legal Defense Fund, and the Community Rights Network. Trusted news media sources mentioned by participants tended to be politically left, and included *National Public Radio*, the *New York Times*, the *Public Herald* (a self-described "muckraking" investigative journalism source), as well as anti-fracking documentaries such as *Gasland*. However, protectionists strongly disagree with claims that their arguments are biased or non-scientific (*35: -2; *47: -3), and see themselves as highly knowledgeable and educated about fracking and its impacts (46: +3). To back up their arguments, many participants in this group cite the work of researchers such as Sandra Steingraber, Tony Ingraffea, Bob Howarth, Michelle Bamberger, and Tom Oswald, all of whom have published scholarly work critical of the shale gas industry.

Of all the groups in this study, environmental protectionists are also the most likely to trust anecdotal or experiential evidence of negative impacts from farmers and landowners (18:

+4). Although protectionists are able to draw on a variety of sources such as those mentioned above to corroborate their arguments, they tend to prefer what one participant called the "boots on the ground" approach to find credible information about fracking, when she described how she approached educating herself on shale gas development:

> I started by going with a neighbor of mine down to the League of Women Voters in Susquehanna County [who] had a series of informational shale gas [meetings]. And I think the night that I knew that something was wrong was when Victoria Sweitzer came up and she showed her water and Senator Yaw[23] told her she was lying…Victoria said come over, see my water…I'll show you that I'm not lying. And he refused to go there…I said let's go visit her, because I'm also the type of person that likes factual information. I don't like to go by what somebody says. So we went to her house and visited and saw the water and I was like – I couldn't believe it. I said I can't believe that our Department of Environmental Protection is saying that this water is alright, safe to drink. It was black, it was sludgy, it was smelly, it was terrible. So then we drove around and I could not believe the operations that were going on and the amount of industrialization that was so close to people's homes. (organic dairy farmer, Pennsylvania, F2 = 0.61)

As this passage indicates, environmental protectionists mention receiving and circulating information about shale gas development through town hall-style meetings organized by local advocacy groups. Many participants also described relying on informal information-sharing networks comprising of friends, neighbors, and nearby farmers who shared their concerns. For example, one participant explained how his neighbors formed an informal group to share information:

> P: We basically just as a group just started researching everything, from you know, people knowing geologists to you know, lawyers getting involved.
>
> I: And when you say as a group, do you mean the [county] landowner group?
>
> P: No, like literally, our group of neighbors. There are probably like ten of us, we would get together like once a month for a year or so, and share our experiences, what was going on, information we knew…Because the main information was being controlled at that point by sort of the landsmen and the companies coming in and giving money to the fire department and having events and things like that, and we were trying to find out

[23] Republican member of Pennsylvania State Senate, representing part of the Northern Tier

> other information other than what was being handed to us by the industry. (diversified organic livestock farmer, New York, F2 = 0.72)

Although environmental protectionists view the debate as far from resolved overall (43: -4; *49: -3) and see a need for continued research (19: +4), they agree that there is sufficient evidence to definitively prove fracking is harmful (54: -3). Furthermore, even protectionists based in New York, where hydraulic fracturing is banned, believe more could be done to limit related industry practices, such as pipeline construction or waste storage. While many protectionists said they were relieved when fracking was banned in New York, no one believed the ban is permanent over the long term. Thus, environmental protectionists agree that environmentally concerned citizens need to remain vigilant and continue advocating against all aspects of fracking in order to continue protecting the land, their farms, and society as a whole. In this, they diverge sharply from the perspective of the next factor, the extraction enthusiasts.

5.4 Factor 3: Extraction enthusiasts – *"Shale gas development saves family farms"*

Of all the factors outlined in this study, extraction enthusiasts are the strongest proponents, and the least critical, of shale gas development (†42: -6).[24] Enthusiasts view shale gas development as contributing greatly to local, regional, and national economic stability:

> We were eight million in the hole in '95, and we are now debt-free, going on four or five years, and we're balancing the budget seven years in a row, no tax increase…All of what we've done here will save them taxes or costs from them, it's a direct result of taking the gift [of shale gas resources], the money from the gift, and not being foolish with it, and invest it in ways that it gives back to the greater population. And it's the generations behind us that are going to see that benefit. This is generational investment. (conventional dairy farmer and county commissioner, Pennsylvania, F3 = 0.54)

[24] While cautious supporters (F1), extraction enthusiasts (F3), and skeptical individualists (F4) all place statement 42 "Fracking must be completely banned" in the -6 column, this statement's z-score is lower for extraction enthusiasts than the other two factors. This means that a larger proportion of participants loading onto F1 and F4 put S42 further towards the "most like my view" side of the board than in F3.

Extraction enthusiasts are particularly concerned that farms in their region are struggling financially and are increasingly unable to make a living through agriculture alone (10: +4). As one participant stated, "You just feel terrible when you know neighbors that continually get in debt, that the price of milk is way down, this year's rains have devastated the hay farms, even some of the dairy men, they've had to find another way to put their crop up. And they are just hanging on…there's not the number of farms there used to be" (conventional hay farmer, New York, F3 = 0.069). This observation – that the number of farms in the region have declined dramatically in recent decades – is frequently made by enthusiasts. One dairy farmer, considering changes in the area's agricultural landscape, reflected:

> Just on this road that I live on…there used to be probably ten dairy farms on this road, it's a ten mile stretch. Now there's only two left. And I'm one of them. And when my two sons in the 70s started kindergarten, they would have the parents come in…I would say probably 80 percent of the parents were farmers. When my grandchildren went to school, and my son went there, he said there was only two other farmers. (organic dairy farmer, New York, F3 = 0.54)

Extraction enthusiasts see the decline of farming and rural economies as particularly worrisome, because they view family farms as a fundamental aspect of American heritage, identity, and economic stability (57: +2). According to members of this factor, farming produces a responsible, hardworking, and trustworthy citizenry. One enthusiast explained that "farmers are very trusting people. They look at people eyeball to eyeball, they shake hands, it's a done deal. Good to go. I've taken you at your word" (conventional dairy farmer and county commissioner, New York, F3 = 0.82). Another farmer argued that agricultural labor promotes fortitude, saying, "Agriculture, in its true application…[is] a real-life experience for you every day, because if it doesn't rain, crops don't grow, but you did everything like you're supposed to…It's what you're dealt. And you move forward" (conventional dairy farmer and county commissioner, Pennsylvania, F3 = 0.54). One participant contrasted the common sense and knowledge

cultivated through farming with what he saw as a lack of judgement in younger generations who did not grow up working on farms: "You can't find people to work…And I used to be able to find some high schoolers…I don't know where to go to find reasonable help, that you don't have to stand there or even work with them and tell them everything they've gotta do… Just a little up here [taps his head], common sense has gotta work" (conventional hay farmer, New York, F3 = 0.069). Thus, according to these farmers, a robust agricultural sector is linked to societal well-being. Furthermore, enthusiasts view the success of farms – particularly the small- and mid-sized farms[25] once common to their region – as important for cultivating a robust middle class. As one enthusiast explained, "A lot of [people] in this area are on government assistance right now. And that's what happens to a community where you lose the small farms" (organic dairy farmer, New York, F3 = 0.54). From this perspective, the hollowing out of the agricultural sector through continued consolidation impoverishes society as a whole.

The majority of extraction enthusiasts are farmers using a combination of methods generally referred to as "conventional" or "industrial" agricultural practices[26]. Thus, it is no surprise that members of this factor are the most likely to see affordable fossil fuels as necessary for a robust agricultural sector (*13: +4):

> P1: One of the biggest needs on a farm is for energy. And if you're talking about diesel fuel being four or five dollars a gallon…energy costs are incredible…and not only on top of that, but fertilizer costs. When the price of oil and everything was up high, nitrogen, urea is a heavy user of energy to be produced. So urea was $800 a ton, in bulk.

[25] When referring to farm size, participants' use of the terms "small" versus "large"-scale farms is somewhat relative. The largest farm in this study sample had a herd size of 240 cows and a farm of 800 acres. Though this size is above average for farms in the Twin Tiers region, he described himself as a "small" dairy in comparison to the growth of extremely large dairies in the western U.S., which can have upwards of 10,000 cows. While there were a handful of dairies in the region milking upwards of 1000 or 2000 cows, they did not respond to my interview requests.

[26] Meaning larger scale production, commodity or mono-cropping production, sales through regional or national markets rather than via direct marketing, mechanization to replace human labor, chemical fertilizer and pesticide use, and/or antibiotic use for livestock.

> P2: Right. And those are things, the farmer has no way to change it. You can't say, well I'll use a different brand of gas. I mean, they're all expensive. Like, maybe you can find a cheaper brand of seed corn, but you can't find a cheaper brand of diesel…I can't think of too many other industries that take more different kinds of energy than farming because you've got all your vehicles, and you've also got all your stationary power needs. You've got your gutter cleaner, you've got your lights and ventilation in the barn. Your ventilation's huge. You've got compressors to keep your milk cool. You've got pumps for your milk. You've got a million different things that take energy, of all different forms. (conventional sheep farmers, New York, F3 = 0.49)

Of all the factors in this study, extraction enthusiasts are also the most negative towards "alternative" and "sustainable" production methods such as organic certification (†12: -1). They disagree that such agricultural practices necessarily result in improved sustainability outcomes or environmental stewardship (11: +6; 15: +2). In fact, enthusiasts believe that conventional production is necessary to feed the world's rapidly growing population (†14: +2), a view which they rank higher than any other group.

As these passages indicate, extractive enthusiasts view fossil fuel use as necessary – and even desirable – for successful and profitable agricultural production. Generally speaking, enthusiasts define a "successful" farmer as one who is able to make a living through agriculture. However, many enthusiasts argue that it is now difficult, if not impossible, to make a living as a farmer. As one participant said, "[Farmers] are having a hard time. I mean, you look at beef farms, three – two years ago, three years ago calves at the auction house were selling for $4 a pound. They were buying 500 pound feeders for $2,000. That price just dropped, so those people that bought those steers lost money, big money, and that's the problem, the markets are constantly fluctuating, and they are just hanging on. They can't survive" (conventional livestock and hay farmer, New York, F3 = 0.50). Several enthusiasts connected the struggle of family farms in the region to the continuing trend of farm consolidation. One fourth generation dairy farmer explained:

> Farms that are here have gotten larger…farms have been getting huge. So it's really escalated the size and prices aren't much better. Like beef prices today aren't much better than they were back when I got married in '74. I sold a nice cow last week, I got $0.45 a pound, and that's what I got for a nice cow back in 1974, because I thought I'd hit the jackpot. I got $0.45, because cows back then were going for $0.18 to $0.25…Corn prices are in the tank. Bean prices are lower. Dairy's struggling to make any money. (conventional dairy farmer and county commissioner, New York, F3 = 0.82)

It is in this context of the "struggling family farm" – meaning agricultural producers who must navigate increasingly volatile agricultural markets, swelling energy costs, growing pressures to scale up production and invest in expensive technologies, and the continued decline of rural agricultural economies – that shale gas development has come to be widely accepted by members of this factor. Extraction enthusiasts argue that the financial benefits offered by shale gas development can help "save family farms" and revive the region's agricultural economy (*6: +3; †8: -5; †32: +1). One New York-based participant, who has been highly active in the region as a pro-drilling activist, described seeing positive impacts across the state border:

> It was easy for me to get examples cause I could just cross the border into Pennsylvania. Cause I'm only five miles from the Pennsylvania line, and I could see what was going on there. We had a couple machinery dealers that were in Pennsylvania that…I dealt with them. He said, I'm just selling everything new…nobody wants to buy used stuff anymore. They come in, they order the tractors, they order the equipment, and another thing I don't have to do is any paperwork anymore, because they're coming in paying cash. (organic dairy farmer, New York, F3 = 0.54)

As these quotations illustrate, extraction enthusiasts believe that shale gas extraction and farming can co-exist without problems (1: +5; 3: -6; 7: -2; *9: -5; 28: -4; 44: -4). They firmly believe there is sufficient evidence to show that shale gas development can be, and is, done safely (54: -3). Enthusiasts also agree that the process is much safer than it used to be (*23: +5), and that current regulations in place in Pennsylvania are more than sufficient to adequately regulate the natural gas industry (39: -4). One participant, a county commissioner in Pennsylvania, argued that the process has been shown to be safe over time:

> Everybody wants this done in as environmentally sound way as humanly possible given the technology as it is. We want to ensure that we have safe water, safe air…We want to ensure that, as much as we're able to…It's not a new technology. It's been around for almost 100 years as far as the hydraulic stimulation of wells. It's been done in areas of the country that probably have some of the most sensitive water tables there are on the face of the Earth, and they've done it very successfully. (county commissioner, Pennsylvania, F3 = 0.63)

However, extraction enthusiasts emphasize that while there should be what one participant called "a sensible program" (organic livestock farmer, New York, F3 = 0.50) in place to ensure safety, it should not unduly burden the industry with too many regulations, thereby impeding economic growth (37: -1; 40: 0; 41: +4). Participants made a frequent observation is that operating unsafely is costly for the industry, and as a result is unlikely to be a systemic concern. As one enthusiast who works as a county legislator explained:

> We want the wells inspected by DEC. We expect the state to be on them and watch to make sure they're drilled properly, they're…concreted in properly and sleeved in the different layers of pipe they put in and so on. We want all that done, and we want it done properly, because we don't want accidents. And I can't believe that the companies want accidents because they've got to pay for the clean-up…if they ruin the neighbors' water. They've got to furnish them with clean water for years, you know? They don't want that to happen. It's money out of their pocket. (conventional dairy farmer and county commissioner, New York, F3 = 0.82)

Extraction enthusiasts do acknowledge that there can be some negative impacts associated with shale gas development (†20: -1; 51: +1). For example, one participant noted that his father-in-law's farm business suffered because the drilling disrupted his harvesting schedule:

> It's basically a double edged sword…When he signed his lease… he wanted to ensure that it would have the least amount of disruption as far as him harvesting crops... And they're putting pipelines through the middle of his fields, basically disrupting his ability to harvest his crops (laughs) right in the middle of harvest season…On one hand, yes, he's getting the revenue from the signing bonuses, and potential revenue from the royalties that he would receive. But you got the day to day operations that you still have to sustain to stay in business. (county commissioner, Pennsylvania, F3 = 0.63)

Extraction enthusiasts thus admit that the economic gains from drilling might not be as big as some farmers hope. However, even if the majority of farmers do not become "shaleionaires,"

enthusiasts still argue that the benefits of the process outweigh the negatives. As one enthusiast explained, “It’s a second income. It’s another form of income. Not everybody’s gonna make a million dollars on this…But majority of the people that get royalties…it’s enough to help them survive in that area, pay their taxes, maybe improve their home, fix up their home” (organic dairy farmer, New York, F3 = 0.54).

Although they acknowledge some potential for some negative impacts from drilling, by and large extraction enthusiasts think the claims made by anti-fracking activists are deeply exaggerated, particularly those relating to environmental outcomes. They are largely dismissive of environmental, public health, and economic concerns relating to shale gas development (†4: -3; ‡5: -3; 26: -5; 27: -1; †30: 0; 47: +3; 53: +1). For example, enthusiasts are the least likely factor to describe hydrofracking chemicals as inherently dangerous (*36: -2). As one participant explained, “As far as the products used…the average person has most of it under their sink and probably has combined them to be even a greater risk than what the industry is using…I’ve asked and I’ve seen the list, and I know that in our home, we have several of those products” (conventional dairy farmer and county commissioner, Pennsylvania, F3 = 0.54). Many of the participants noted that anti-drilling activists frequently referred to instances of water contamination in Dimock, Pennsylvania in the early days of the shale boom, which were widely publicized in the news media. While they vary somewhat on how seriously they regard these accusations, enthusiasts agree that fracktivists have blown the issue out of proportion. As one participant explained, “I think the anti-group was being very emotional, and they were skewing the data, they kept bringing up the same people with the water problem down in Pennsylvania” (conventional livestock and hay farmer, New York, 0.50).

In addition to their skepticism towards water quality concerns from shale gas development, extraction enthusiasts are also the least concerned factor about climate change (2: -2). In fact, two participants in this factor stated they do not believe climate change is real or caused by humans. Thus, while they agree more strongly than other groups that natural gas can be a "bridge fuel" to renewable energy (52: +3), enthusiasts remain unconvinced by the need for renewable energy. As one participant stated, "It's been proven in Germany, it's been proven overseas. Solar does not cut it. You're not gonna do it all in on solar. You're not gonna do it all in wind power. It's not gonna happen" (conventional goat farmer, New York, F3 = 0.50). While some enthusiasts expressed dissatisfaction that zoning regulations in their town prevented them from leasing their land for a wind turbine as well as for hydraulic fracturing, their reasoning was due less to the belief that renewable energy is preferable, and more because of their view that landowners should have the right to do what they want on their private property (17: +2; 56: +3).

Although extraction enthusiasts are not overly concerned about the environmental consequences of shale gas development, they are deeply offended by insinuations from anti-fracking activists that they do not care about the environment. In fact, enthusiasts placed the statement "I see farming as an act of environmental stewardship" (11: +6) higher than any other factor, probably as a reaction to what they see as insults from anti-drilling groups:

> They criticize a lot of people that are for natural gas, oh they don't care about the environment. And that really insults me when somebody says that to me because my livelihood depends on my stewardship for the environment. If I don't take care of my property and my land, it's not gonna produce for next year. So, I'm very concerned about the environment…I work in the environment every day…That's what the anti's will hit you with all the time. Ah, you don't care about the environment. You don't care about the planet. (organic dairy farmer, New York, F3 = 0.54)

In fact, extraction enthusiasts argue that shale gas drilling is actually more environmentally friendly than most other forms of mineral extraction, because only one well pad is needed to drill a much larger area than conventional drilling. One participant, while relating the story of an

interview with a journalist he suspected of having an anti-gas perspective, contrasted the "pastoral farmland and the river valley" he showed her with the "toxic waste site" she expected to see (county commissioner, Pennsylvania, F3 = 0.63). From this perspective, the shale gas industry is helping support family farms not only by financially saving struggling farmers, but also by preserving the region's rural character and aesthetic beauty.

Extraction enthusiasts distrust any claims or information originating with anti-fracking activists and environmental organizations, which they see as deeply biased and emotional (47: +3). They frequently contrast what they see as their own rational, calm, and well-informed perspective with that of anti-drillers, who they describe with terms like "rabid," "extreme," "dogmatic," and "hyperbolic." One pro-drilling advocate recalled town meetings from the height of the debate in New York: "It seems like it was just one roadblock they were putting up after another. They would come up with issue, and…we would show them that was false…And then they would come up with something else" (organic dairy farmer, New York, F3 = 0.54). Another participant observed that "by people being so hysterical about [fracking] in this area, that they've precluded any rational examination of the problem" (organic livestock farmer, New York, F3 = 0.50).

Similarly, extraction enthusiasts do not tend to believe claims from farmers or landowners who say shale gas development has hurt them or their land (*18: -3). One participant recalled an incident where a Pennsylvania man "put mud in his water and then tried to show it off as, this is what's happening to our well because of fracking…it was proven that, that he…essentially tainted his water so it looked brown and whatnot" (conventional hay farmer, New York, F3 = 0.69). A common explanation forwarded by participants was that false reports of contamination came from residents who were not getting much, if any, financial benefit from

shale gas development: “The people that complained the most from what I’ve been told is the ones that didn’t own much land, they weren’t going to get much money…They’re saying their water went bad is mostly from jealousy” (conventional dairy farmer and county commissioner, New York, F3 = 0.82).

In terms of trust in government institutions, extraction enthusiasts are split between those located in New York and Pennsylvania. New York-based participants express deep distrust in their state government due to a state-wide ban on hydraulic fracturing announced in 2014 by Governor Andrew Cuomo. Many participants refer to shale gas development as a “political football” in the state, blaming partisan politics for why the practice had been banned. Enthusiasts frame the ban in terms of competing rural and urban politics, with some arguing that the decision is a deliberate attempt to continue disenfranchising conservative rural voters:

> My personal opinion is when Albany saw that [farmers were getting wealthy], a lot of lights went off up there, and it was about that time that they started to hit Pennsylvania with some big wells in the fracking [and] started talking about coming to New York state. And I think it’s that…they didn’t want this area to become that wealthy…They put a squash to it, because they were afraid of this area becoming too dominant in New York politics, because it’s a conservative area. So, you know, that’s one theory that a lot of people have. (organic dairy farmer, New York, F3 = 0.54)

Two participants also shared a suspicion, which they heard circulated on a right-wing radio talk show out of Albany, NY, that Governor Cuomo and several anti-fracking organizations were funded by Russia because “if we became self-sufficient in oil and gas, then there’s less a demand for Russian natural gas and Russian Oil. Europe may well turn to us and buy some from us instead of being dependent on the Russians” (organic livestock farmer, New York, F3 = 0.50). While not all enthusiasts view the state government in this manner, they do share a belief that Governor Cuomo was bending to the will of his liberal, urban constituency in his decision to ban hydraulic fracturing – a decision which many of them feel is discriminatory towards struggling farmers in the region.

Although extraction enthusiasts exhibit the highest level of trust in the oil and gas industry of all factors (*21: -1; †33: -1), they do not trust the industry without reservation. As one participant reflected, "I want people educated so they don't get a bad lease, because these people, they're looking out for themselves…Maybe they'll take you out and buy you a dinner at a restaurant or something, but that's nothing. And they'll try to be your friend. They really aren't your friend" (conventional dairy farmer and county commissioner, New York, F3 = 0.82). However, as a group they are still more willing to believe the industry perspective than any other factor, particularly environmental advocates. One enthusiast reflected that her relative lack of distrust could have played a role in the positive experience she and her husband had with the industry:

> I think if more people…had a little bit more willingness to try and understand what's being told to them, rather than immediately going, oh my god, that sounds scary…The gas company was so open about answering our questions. You know, we didn't come at them in any accusatory or suspicious-looking type of questions. And they were glad to tell us information. (conventional sheep farmer, New York, F3 = 0.50)

Extraction enthusiasts also find what they consider to be credible information from such sources as their state farm bureau, local landowner coalitions, and Penn State Cooperative Extension (they tend to view Cornell Cooperative Extension as biased towards both anti-drilling and organic farming). Many participants also cited conservative news outlets; one enthusiast had Fox News on in another room during the interview. Furthermore, several enthusiasts described how newsletters and email listservs set up through organizations like their county landowner coalitions became valuable sources of information. However – similar to environmental protectionists – extraction enthusiasts ultimately trust their own judgement above all else, saying that they are able to "listen to both sides" and make a rational, well-informed decision (*46: +6). As one farmer explained, "I went to a lot of meetings, and obviously both sides were represented, and I would just listen to them…When somebody starts telling me bullshit I can tell

it's bullshit (laughs)" (conventional hay and livestock farmer, New York, F3 = 0.50). Yet, also similar to the protectionists' approach, those enthusiasts who had personal experiences with the oil and gas industry found that first-hand knowledge most valuable of all. A quote from one farmer is representative of this perspective:

> How I learned is, I actually went to the well site, and watched what they did. And I was allowed on that well site, by hook or crook they let me on the well site. (laughs) I mean, being a neighbor next door to the property, oh yeah, come on, they were happy to show you what was going on. And I got to know the guys and what not. And I saw what was going on first hand. (conventional goat farmer, New York, F3 = 0.50)

In short, extraction enthusiasts are highly confident that they are knowledgeable about shale gas development (*46: +6). They are especially motivated by the promise shale gas development holds for economic stimulation, which they believe can save struggling family farms, and thereby support rural development. They remain unconvinced by the arguments leveraged by environmental advocates against drilling, and believe shale gas development can be accomplished safely, in large part because – relative to the other factors – they trust the natural gas industry to use best practices. In this, they differ from the fourth and final factor, the skeptical individualists. While both of these groups agree that farmers should be able to profit from their private property, skeptical individualists find industry claims – and indeed, the claims of nearly all institutions – highly dubious.

5.5 Factor 4: Skeptical individualists – *"Private property rights must be protected"*

What sets skeptical individualists apart is that, unlike the previous three factors, they do not see themselves as part of the shale gas debate – an interpretation supported by their high placement of statements such as seeing family farms as the foundation of American heritage (*57: +5). While both environmental protectionists (F2) and extraction enthusiasts (F3) rank this item positively, those factors rate statements more highly which relate directly to shale gas development, due to their stronger concern over shale gas. In contrast, individualists do not view

shale gas development as an especially important topic, even though four of the seven participants in this factor have leased their subsurface mineral rights for oil and/or shale gas extraction.

Tellingly, skeptical individualists are the least likely of any group to describe themselves as knowledgeable about hydraulic fracturing (*46: -2), to agree there is scientific consensus on the long term impacts of hydraulic fracturing (19: +3; *54: +3), or to say the debate over shale gas development has been resolved (†43: -5). When asked where they looked for information on shale gas development that they found trustworthy and credible, many participants in this group said that they didn't know where to look, or that they had not done much research on the topic, further supporting the contention that they do not see themselves as part of the shale gas debate. One participant gave a representative reply:

> I wish we had honest [information]...I do not believe that that's available. I have not been able to find it anyway. Several things that we've looked at online, and I have not spent a lot of time doing a lot of research on fracking… my biggest complaint about this whole thing is they just don't know. Maybe we've already done the research and people do know the answer. I just don't know that we've got an honest broker on either side...I think both are way right and way left and I just want somebody to honestly tell me what's going on. (sustainable/non-organic orchardist, New York, F4 = 0.50)

As this quotation illustrates, skeptical individualists believe the debate has become overly polarized, making it difficult to parse what is and is not true. In this sense, individualists share common ground with environmental protectionists (F1), with each group seeing themselves as occupying a moderate viewpoint towards shale gas development (†24: +2; 49: +2; 51: +2; 55: +5). As one individualist put it, "Yeah, let's drill, but let's not go buck wild, let's not put our faith in a government entity or a corporation, let's go forward and let's do it conservatively if we can, yeah. So kind of slow and steady" (sustainable/non-organic livestock and maple syrup farmer, New York, F4 = 0.76).

Skeptical individualists by and large see themselves as a neutral and disinterested third party between the more polarized positions exemplified by the environmental advocates and extraction enthusiasts. Individualists deplore what they see as these polarized extremes driving the debate. As one participant explained, "So many of these groups don't appear to listen, to look at, or have any respect for the other guy's point of view" (conventional produce farmer, Pennsylvania, F4 = 0.52). Overall, individualists feel that the polarized nature of the shale gas debate prevents stakeholders from either position from engaging in constructive dialogue. As one participant stated, "I think if you take away the emotions and start having real conversations, you know, you find out there's just people on both sides looking to do what's best" (sustainable/non-organic livestock farmer, New York, F4 = 0.54).

As this last quote suggests, skeptical individualists are unwilling to take what they see as extreme positions towards shale gas development. For instance, individualists strongly disagree that fracking is inherently dangerous or needs to be banned (3: -6; 42: -6). As one participant explained, not enough is currently known to definitively say fracking should be banned: "I just don't think we know enough to completely ban it or to say all bets are off, knock yourself off, frack wherever you want. So I just -- that to me was too absolute" (sustainable/non-organic orchardist, New York, F4 = 0.50). Thus, like cautious supporters, skeptical individualists range from neutral to dismissive on most concerns relating to the purported negative environmental (01: +3; *23: -1; 39: 0; 44: -3), economic (‡5: -1; 7: -2; *8: 0; 21: +1; 26: -4; 27: -1), or social (4: -1; 28: -2; 30: -4) impacts of shale gas development. For example, one participant noted that while mistakes can happen, they aren't necessarily systemic or inevitable:

> I don't think for a minute that the gas companies are doing anything that they consider deliberately dangerous, but any time that you do anything, you are still going to have mechanical failures and human errors, just reality, and that's part of the water damage with the fracking, you know…Preventable medical accidents are like the fifth largest

> killer of people in this country. Okay, you're not going to ban doctors, but yet failures and lapses in judgment in the medical field killed people, you know? These things with the fracking, they're accidents. (conventional produce farmer, Pennsylvania, F4 = 0.52)

As this statement shows, skeptical individualists remain unconvinced by many of the claims by anti-fracking activists that shale gas development will have dire consequences. But at the same time, individualists are neutral or dubious toward many pro-drilling claims as well (*6: -2; †18: +2; 29: +1; 32: -1; 33: -3; 35: 0; 47: +2; 52: 0; 53: 0). Furthermore, individualists acknowledge that gas drilling can result in adverse effects for some farmers (†20: -3), and do not agree that the process is completely safe. Individualists therefore tend to be moderate in their claims for the benefits accruing from shale gas development. For example, one participant who signed a lease in 2006 used his royalties to switch from dairy to vegetable and beef production. However, he observed that the long-term financial impacts remained unclear:

> Early on, I would say it's a benefit, and then (sighs) – yeah. I mean, long-term, it's hard to say how beneficial it is. But there were a lot of new tractors bought, new equipment bought, which in most cases, was really needed, because a lot of 30- and 40-year-old stuff that (laughs) – deal with. Although the new tractors have had more problems than the old ones ever did…And I know there's been a number of farms around that have, you know, modernized – not necessarily modernized, but repaired buildings that were in decline, and farmers have remodeled their houses and went from an old farmhouse to a nice house. All I did was put it towards the greenhouses (laughs). (conventional vegetable farmer, Pennsylvania, F4 = 0.59)

Another individualist likewise observed a mixture of positive and negative economic outcomes for the agricultural sector from the shale gas boom. Having worked at a local farm supply store and feed mill for most of his career, the participant noted that he was able to observe several trends impacting the agricultural sector at the regional level, rather than just at the scale of his individual farm:

> [It's been] good and bad…There were a lot of small businesses [like the feed mill] that have taken in money from the gas industry as far as selling parts…selling seed and fertilizer and stuff there...By the same token, because the gas industry jobs have paid better. A lot of small businesses have lost good employees. You know, you would have a guy working for $12, $14, $15 an hour, what a local business could afford to pay. All of a

> sudden he could go make $25, $30 an hour in a gas field, so they lost a lot of your good people. (conventional produce farmer, Pennsylvania, F4 = 0.52)

In terms of how skeptical individualists compare to environmental advocates and extraction enthusiasts, individualists also see themselves as strong environmental stewards (11: +4). They also agree with extraction enthusiasts that family farmers in the region have been struggling economically (10: +4), with many participants commenting on increasing farm consolidation trends. One individualist reminisced, "These big farms that are getting bigger and bigger and bigger all the time, they keep sucking up all the land…Drive up [the state road]. You'll see it. There's a farm every quarter mile or less, and the barns are falling down" (grass-based dairy farmer, Pennsylvania, F4 = 0.57). Yet while they agree with extraction enthusiasts that farms in the area are in financial crisis, skeptical individualists differ from enthusiasts in that they view transitioning to "alternative" agricultural production as a viable economic strategy to address the issue of "struggling family farms" (12: +4).

Like environmental protectionists, individualists tend to be interested in environmental sustainability (25: +6), and strongly believe in the environmental and economic benefits of so-called "alternative" production practices (13: 0; 14: -3; 15: +6). Of the seven farmers who load onto this factor, six use some mixture of non-conventional agricultural production methods, including intensive rotational grazing management; grass-based dairying; and/or direct marketing to consumers through on-farm sales, farmers markets, or CSAs. However, they diverge from environmental advocates in that they believe sustainable food production and fossil fuel extraction may co-exist without issues (1: +3; 9: -1). Additionally, skeptical individualists diverge from the environmental protectionist collectivist ethos, which views environmentally sustainable models as necessary for ensuring collective wellbeing and the continued protection of shared environmental resources. Instead, individualists cite an economic rationale as their

motivation to adopt sustainable agricultural methods. One participant summarized up the difference in collectivist and individualist philosophies in this way:

> It's not my job to feed your family, but to feed my family. (laughs)…I think that's true though…You guys think that food should just be there. (laughs) No, it doesn't work that way. You don't work, you shouldn't eat. You know, the Bernie Sanders ideas where everything's free, education, food, healthcare, it doesn't work that way. You've got to pay for those things. (sustainable/non-organic livestock farmer, New York, F4 = 0.54)

For example, one farmer explained that, although his daughter runs their dairy business as pasture-based – a production method generally viewed as non-conventional – he described their reasoning as economic rather than philosophical:

> P: It's the cheapest milk you could possibly make is the way we've got it set up. And we had it figured that she could cash flow at $10 [per hundredweight] for milk, which is dirt. The first month she got paid $10.46 a 100, something like that. So she worked the whole month for $300…but she has no debt…She raised all of her animals, and we built the barn a little at a time, and so she has no debt, but you know, these guys – Well, we hear it all the time, guys come in here and sit on the stool and tell us, you know, they cash flow at $18 a hundredweight. Well, when your milk checks $14 a hundred and your cash flow is $18 a hundred, that don't give you nothing to live on. You're losing $4 a 100 every 100 pounds of milk goes out the driveway.
>
> I: When you say she's doing it, making milk as cheap as possible, like how –
>
> P: She grazes. Don't push on the feed, grazes. The cows are housed outside for the most part. They come in, they get milked, they go back out. (grass-based dairy farmer, Pennsylvania, F4 = 0.57)

Similarly, another farmer who transitioned from conventional dairying to an intensive rotational grazing model explained that his decision rested on the ability to have a more productive business model by removing himself from the grind of agricultural market forces:

> I stumbled across [Joel Salatin], and here's a guy saying everything you know is wrong, and this is a method where you can make money at farming. Well, that's a completely different psychological approach than, god, just going down to an auction house and listening to other farmers bitch and vetch about pricing and all that stuff, and here's Joel saying set your price, be a price maker, don't take what price the industry will give to you. And so I started that year applying a lot of his philosophy. I haven't bought any fertilizer since then, since 2010, that's seven years. And if we look at production per acre, I'm as competitive as anybody out there…You don't have to kill yourself with labor, and you don't have to just sit, you just don't have to be a victim, and I liked that, I liked the

> idea that my fate was determined on my own cleverness and my own willingness to work. (sustainable/non-organic livestock and maple syrup farmer, New York, F4 = 0.76)

The last line of this passage illustrates a key component of the skeptical individualists' worldview: they celebrate self-sufficiency, independence, and personal autonomy. Thus, they believe farmers should have the right to do what they want on their private property (17: +3; 37: 0; 56: +4), whether that means the ability to lease subsurface mineral rights or to use certain agricultural production methods and technologies. It follows that, by and large, individualists are deeply distrustful of any institution that they feel is attempting to constrain their actions or choices, including state and federal governments, Cooperative Extension, and the natural gas industry.

Like both environmental advocates and extraction enthusiasts, skeptical individualists are distrustful of government intervention when it comes to shale gas governance (36: -5; *38: -5; 40: 0; 41: +3; †50: -3). However, for individualists this distrust stems from an overall distaste for government intervention, rather than being specific to the issue of shale gas drilling. For instance, several participants laughed when reading the statement "If hydrofracking chemicals are truly dangerous, the government would have banned them" (36: -5). The primary reason why individualists dislike and distrust government institutions is due to the perception that the government can, and intentionally does, prevent them from fully exercising their private property rights. Individualists located in New York, where a ban on hydraulic fracturing has been in place since 2014, expressed this attitude through their contempt for what they saw as a blatant effort to suppress the private property rights of landowners. Yet even individualists living in Pennsylvania are skeptical of the government's intentions, and suspect that many regulations are in place solely to generate money for corrupt politicians and facilitate political agendas. One dairy farmer gave an illustrative example:

> P: You know, everything has a cost…Anything to do with the government, there's strings attached.
>
> I: So you just stay away from it?
>
> P: We have since we got out of FHA [Farmers Home Administration][27]. When I built this barn, my cows were financed through FHA…But twice I was three years away from being paid off and FHA put me back into debt. Because they give you the money at a low interest rate, but then there's strings attached, and the biggest string is anything here after required is their collateral…So if you buy a tractor with your money from the farm, they have a lien on that. So you can't use it to borrow from a bank, because they have a lien on everything you own, so you can't get away from them. And we were doing real well when we was milking 60 cows in here, and I got three years away from being paid off, and they says, you've got to put on 10 more cows or pay the balance of your loan. Well, I couldn't come up with three years' worth of money, and you can't borrow against it because they have a lien on you. So we built on 30 more feet. We put on 10 more cows. You got 10 more cows, you've got to feed 10 more cows. Well, we didn't have the land base to feed 10 more cows, so then we had to truck hay from everywhere on Earth, and that was a big expense…So I had to refinance for 10 more years…But when I took home my last check, I slid it across the counter to them, and I said this is just like buying my soul back from the devil. They were not happy with me. (laughs) (grass-based dairy farmer, Pennsylvania, F4 = 0.57)

As this statement shows, this participant framed his experience within the broader skeptical individualist perspective of a corrupt government agency which makes money off the backs of farmers like himself, thereby locking him into a cycle of debt and constraining his ability to make independent decisions about his business and property.

Skeptical individualists also distrust the oil and gas industry, who – like the government – they suspect of putting their own interests and profits above the interests of landowners (21: +1; 33: -3). One participant in particular felt he had an axe to grind with Chesapeake, the company responsible for drilling his land. Under his lease, Chesapeake was able to deduct various costs for maintenance and transmission. As a result, even though his lease specified a 12.5% royalty payment,

[27] A former government agency that operated from 1946 to 2006, and aimed to stimulate rural development through credit programs aimed at farmers and other rural residents.

> There's been times when we got less than 1%, half a percent, when the price of gas was low and they're taking out the same amount all the time for various deductions…I do hope that eventually, gas companies will be forced to at least pay the landowner a 12.5% minimum royalty. But I don't anticipate that ever happening…Because things that seem so obvious sometimes – it's not a matter of right and wrong. It's a matter of legal and illegal and how much they can twist the facts to be on their side. (conventional vegetable farmer, Pennsylvania, F4 = 0.59)

Yet while individualists blame the oil and gas companies for what they see as profiteering at the expense of struggling farmers, they also argue that responsibility ultimately lies with the landowner to negotiate with the industry:

> The land man comes into your house and he does his level best to make it appear that he's your friend, but his job is to get Shell the best deal possible. And you're responsible as a landowner to get out to the meetings, to do some research, to hire a good lawyer or join a group or both, to make sure that you get the best deal possible for you, and far too many people just a land man come in and says well, here's what we're offering, and it was a lot of money, and they just took it, and they didn't look at the details. (conventional produce farmer, Pennsylvania, F4 = 0.52)

As this statement alludes, skeptical individualists do have certain sources they viewed as more trustworthy and credible than others. Several participants referenced local landowner coalitions as key purveyors of information while they navigated the leasing process.[28] Some individualists also cited members of Penn State Extension as useful sources of knowledge, particularly early in the shale gas boom. However, as a whole, individualists are somewhat dubious about viewing Cooperative Extension as an important knowledge-sharing institution (22: -3; 34: -2) – perhaps in part because they do not agree that farmers need additional education at all (16: +1). In keeping with their valorization of self-reliance and personal freedom, individualists dislike being told what to do and how to do it. One individualist stated, "They're kind of behind the times for me," explaining that he prefers to learn new skills on his own (sustainable/non-organic diversified farmer, Pennsylvania, F4 = 0.58). Other participants noted

[28] Landowner coalitions seek to pool land from a group of landowners, in order to negotiate a more favorable lease than they can get individually.

their extension offices did not provide applicable information for their agricultural production practices (for example, focusing on dairy instead of produce), or that they felt extension had moved away from farmer education to a broader consumer base in an effort to stay profitable (for example, teaching canning and gardening classes).

By and large, skeptical individualists represent a group of agricultural producers whose interest in shale gas development is framed solely through the lens of private property rights. Unlike the other three factors in this study, individualists are agnostic on the question of whether shale gas development is a beneficial or detrimental practice across economic, environmental, and social domains. Rather, they are primarily concerned with preserving the right for farmers and other landowners to operate independently, without constraints on their ability to run a business and profit from their mineral rights if they so desire.

5.6 Upsetting discursive binaries: consensus and divergence

Although the narrative interpretations above highlight what is unique about the perspectives represented by each factor, there are also zones of consensus between individual perspectives, and potentially shared by all of the identified factors as a whole. This section aims to illustrate the broad contours of consensus and divergence relating to how all of the factors together view the relationship between shale gas development and agricultural production.

As outlined in Chapter 4, one of my central questions in this study was to see if, by identifying multiple worldviews at the intersection of shale gas and farming, I could deconstruct the over-reductive economy/environment binary framing the shale gas debate. On the one hand, the study does appear to have successfully accomplished this goal by producing and interpreting four distinct worldviews who view the shale gas and agriculture juncture in different ways. Of these four perspectives, two factors – environmental protectionists (F2) and extraction

enthusiasts (F3) – do appear to align with the bipolar narratives of environmental degradation and economic success, which further conflates with anti- and pro-drilling stances. Meanwhile, the other two factors – balanced rationalists (F1) and skeptical individualists (F4) – occupy stances that are arguably in the middle ground of the debate, where they both agree and disagree with some aspects of the advocates' and enthusiasts' arguments. Furthermore, passages from the semi-structured interviews illustrate that participants have more nuanced views at the economy/environment intersection than a binary framing indicates. For instance, environmental protectionists highlighted the ways that they worried shale gas development could impact their agricultural businesses, while extraction enthusiasts took issue with the idea that they are careless environmental stewards.

However, a deeper look into the data reveals that a binary either/or discourse continues to influence how all four factors relate to one another. Correlations between factors (Table 5.2) illustrate the broad levels of agreement and disagreement between factors. The only two factors that are negatively correlated, indicating that they disagree on more than they agree, are the environmental protectionists and extraction enthusiasts. Meanwhile, the balanced rationalists and skeptical individualists are positively correlated with all of the other factors. Yet when examining the patterns of correlation between all factors, a pattern emerges: the environmental protectionists have a lower overall level of correlation with these two factors (at approximately the 22 and 20 percent level, respectively) than the extraction enthusiasts, who correlate with those factors respectively at 52 and 48 percent. Likewise, the supporters and individualists have a high level of agreement, correlating at approximately 57 percent. This pattern indicates that the supporters, enthusiasts, and individualists have far more in common with each other than with the environmental protectionists.

Table 5.2: Factor score correlations

	F1 Balanced rationalists	F2 Environmental protectionists	F3 Extraction enthusiasts	F4 Skeptical individualists
F1 Rationalists	1.0000	0.2223	0.5159	0.5744
F2 Protectionists	0.2223	1.0000	-0.2791	0.2015
F3 Enthusiasts	0.5159	-0.2791	1.0000	0.4780
F4 Individualists	0.5744	0.2015	0.4780	1.0000

The reason for this pattern comes down to the question of whether or not shale gas development should be completely banned. As the narrative interpretations indicate, environmental advocates argue that fracking needs to be banned (*42: +5), while the other three factors believe the opposite (42: -6). In other words, these worldviews continue to organize around a pro-/anti-drilling dualism, which boils down the question of shale gas development into an either-or question: either shale gas is banned, or it is permitted. Thus, the pro-/anti-drilling binary continues to exert considerable influence on the ways that shale gas development is framed in the context of agricultural production. The pro/anti-drilling frame also articulates with the economy/environment binary, with environmental risk and economic stagnation forming the motivating force behind environmental protectionists' and extraction enthusiasts' respective worldviews.

Table 5.3: Consensus statements shared by all factors

Statements	Balanced rationalists	Environmental protectionists	Extraction enthusiasts	Skeptical individualists
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-1	-3	-1

The analysis only identified one consensus statement, meaning a statement which all four factors similarly ranked (Table 5.3; see also Appendix B.4.1). All four factors appear to be neutral or mildly disagree that royalty payments have increased inequality between farmers. However, data from the qualitative interviews demonstrates that different participants interpreted this statement in diverse ways. For example, some participants agreed that royalty payments have increased inequality between New York and Pennsylvania farmers, while others focused entirely on farmers within their community and disagreed, or were neutral. One participant questioned the premise of the statement, saying that many farmers in the area only have land because it was stolen from Native peoples and African Americans. As a result, what appears to be consensus on this statement instead is likely the result of averaging together a variety of heterogeneous interpretations.

While the consensus statements shared by all factors do not appear to add much value to the analysis, the consensus statements between pairs of factors provides another avenue to compare patterns between factors. PQMethod software does not generate consensus statements between factor pairs (e.g. between factors 1 and 2) the way it does between all factors. However, the software does use each factor's z-scores to generate a "descending array of difference" between each factor. Simply, it compares the z-score for each statement and calculates the difference. Statements with a larger value indicate that the two factors sorted the item differently, while values closer to 0 indicate the factors sorted the statement similarly (see Appendix B.4 for consensus statements between factor pairs).

Table 5.4: Consensus statements between Factor 2 and Factor 3

Statements	Environmental protectionists	Extraction enthusiasts
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-3
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.	0	0
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.	0	0
29. Well-off "fracktivists" just want to keep the landscape looking a certain way.	-2	-1
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.	-1	-1
38. We should have a federal policy as a foundation for regulating shale gas development nationally.	0	3
43. I think the debate over fracking has been more or less resolved at this point.	-4	-4
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.	1	0
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.	-1	0
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.	-3	-3
55. I think both pro- and anti-drilling groups are guilty of misrepresenting science to suit their arguments.	0	0
57. I see family farms as the foundation of our country's heritage.	2	1

Of particular interest are the consensus statements between the environmental protectionists and extraction enthusiasts, given that they are the only two negatively correlated factors (Table 5.4). Some areas of convergence include being neutral, or mildly disagreeing, that Cooperative Extension has played an important role in farmer education, particularly in the context of shale gas development (16: 0, 0; 34: -1, -1). Additionally, both groups appear to be neutral or to mildly disagree on whether government studies are politically biased (50: -1, 0), and to mildly agree that farming is an important aspect of American heritage (57: +2, +1). However, several statements are interesting in that the apparent convergence between advocates and enthusiasts actually obscures a deep division in how the statement is interpreted. For example,

both factors ranked statements 24 ("I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous") and 55 ("I think both pro- and anti-drilling groups are guilty of misrepresenting science to suit their arguments") in the 0 column. Yet while protectionists indicated through their interview responses that they disagreed that anti-drilling groups misrepresent scientific information to further their agenda, the opposite was true for enthusiasts. Relatedly, both groups do agree that there is sufficient research and scientific data to make an informed decisions on its long-term effects (54: -3, -3). Nonetheless, the two factors diverge on what they believe the scientific consensus is on shale gas development: protectionists believe the science proves shale gas development is environmentally harmful, while enthusiasts say it shows the process to be safe.

In short, while the analysis does interpret additional viewpoints outside of the oversimplified economy/environment discursive binary shaping public debate over shale gas development, it also illustrates how a related pro-/anti-drilling dichotomy continues to shape how these four worldviews relate to one another to some degree. The position taken by environmental protectionists, which advocates for a complete and total ban on shale gas development and its related activities, draws a line in the sand: you are either for shale gas, or against it. As one balanced rationalist explained in her interview, "If you weren't anti, you were pro" (county planner, New York, F1 = 0.71). However, the next two chapters continue to deconstruct the dichotomous framing of the shale gas debate by deploying an environmentality framework to analyze the uneven, shifting, and historically contingent networks of environmental knowledges, politics, institutions, and subjectivities which come together to form some subjects as shale gas subjects. In this way, I am to illustrate how either/or binary discourses obscure the complexity and instability of environmental subjectivities which drive participants' behavior and practice.

CHAPTER 6

GEOLOGICAL SUBJECTS AND INFORMATIONAL ASYMMETRIES: CRAFTING INSTITUTIONAL CIRCUITS OF KNOWLEDGE, DISCOURSE, AND POWER

6.1 Introduction

As the previous chapter illustrates, each factor produced through this Q study represents an idealized social perspective that views the agriculture/shale gas juncture in a particular way. This chapter begins to examine each of these factors through the lens of environmentality, by identifying and analyzing the diverse articulations of environmental discourses, knowledges, and institutions which come together to differentially shape individuals as environmental subjects. I aim to show how the worldviews represented within each factor take on significance with and through institutional networks of environmental knowledge production, circulation, application, and erasure, and how this process is made possible through the medium of discourse. I wish to reiterate that the results of a Q methodology study are descriptive, rather than prescriptive: these findings are not intended to apply to all farmers or rural residents living in the Twin Tiers region or the Marcellus Shale Basin. However, the findings outlined here do highlight certain trends which this dissertation interprets through an environmentality optics, and which could be productively interpreted using methods such as survey or census data analysis to identify more generalizable conclusions.

I focus specifically on the role of environmental knowledge and information as key discursive representations within the shale gas debate. These representations, and the different claims made on their behalf, produce highly uneven topographies of knowledge and power upon

which the shale gas debate plays out. Different stakeholders seek to mold these topographies in ways that serve their interests, largely by manipulating how and what types of environmental knowledge are produced, and thereby seeking to govern the flows of information-sharing through discursive circuits. The negotiations and contestations between divergent claims of legitimacy and authority give rise to a politics of knowledge and expertise, as different groups pursue control over how shale gas development is represented and what environmental subjectivities emerge as a result.

In the first half of this chapter, I deploy the Q study results summarized in Chapter 5 to illustrate how study participants demonstrate differential patterns of alignment within and across a diverse set of demographic domains. I examine how these configurations relative to six demographic variables – location, drilling/leasing status, political orientation, education, profession, and agricultural practice – to delineate the contours of complex networks shaping discursive (re)production and circulation between and within each factor. In the second half of the chapter, I examine three key institutions – private property regimes, the oil and gas industry, and Cooperative Extension – and how they shape these discursive networks, thereby governing flows of knowledge and other discursive representations. This section also examines how an uneven politics of knowledge and expertise in the shale gas debate, produced and contested at the articulations between these institutions, produce deep informational asymmetries between farmer-landowner and natural gas industry stakeholders. Together, I illustrate how these three institutional actors come together to co-produce farmers as key geological gatekeepers and shale gas environmental subjects.

6.2 Circuits of discourse and knowledge

Several patterns emerge when looking at the participants who load onto each of the four factors identified and interpreted in the previous chapter. Broadly speaking, the participants within each factor illustrate trends whereby they align along intersecting domains of location, leasing status, political orientation, education, profession, and agricultural practice. However, each variable alone is insufficient to fully explain how the different factors orient towards shale gas development as described in Chapter 5. I argue that the interplay across and between layers of diverse demographic characteristics shape circuits of discourse, through which information pertaining to shale gas and agricultural production is generated, shared, contested, and reproduced. In this section, I outline how participants in each factor align along each of the highlighted characteristics, and how these patterns illustrate the complex networks governing both formal and informal information sharing within and between factors.

6.2.1 Location

Each factor contains participants who work and/or live in both Pennsylvania and New York (Table 6.1). However, the extraction enthusiasts and environmental protectionists – who encompass polarized pro- and anti-drilling worldviews within the shale gas debate, respectively –predominantly comprise participants located in New York. Eleven out of fourteen environmental protectionists and nine out of eleven extraction enthusiasts live in New York. On the other hand, the balanced rationalists and skeptical individualists – who occupy what appear to be moderate positions in the shale gas debate – are more heavily populated with Pennsylvania-based participants. Eight out of eleven balanced rationalists and four out of seven skeptical individualists live in Pennsylvania.

Table 6.1: Location by factor

Location	F1 Balanced rationalists	F2 Environmental protectionists	F3 Extraction enthusiasts	F4 Skeptical individualists
N	N=11	N=14	N=11	N=7
New York	3 (27 percent)	11 (79 percent)	9 (82 percent)	3 (43 percent)
Pennsylvania	8 (73 percent)	3 (21 percent)	2 (18 percent)	4 (57 percent)

The scholarly literature on shale gas developments highlights several potential explanations for this trend. Clarke et al. (2016) argue that geographic distance mediates political ideology, such that politically liberal residents – who tend to oppose hydraulic fracturing – are more likely to support the practice the closer they live to active extraction sites, which arguably accounts for part of the difference in levels of support between Pennsylvania and New York states. Additionally, areas with a history of extractive industry, like Pennsylvania state's legacy of coal mining, are more likely to support shale gas development (Boudet et al., 2016; Bugden et al., 2017).

A further explanation argues that Pennsylvania residents would be more likely to be ambivalent towards shale gas development as an effect of neoliberal logics which normalize the impacts of natural gas extraction in communities experiencing the shale gas boom (Finewood and Stroup, 2012; Malin, 2014). Taken together, this body of research posits that location plays a significant role in mediating acceptance and rejection of the shale gas industry. Residents who are more familiar with shale gas development because they have experienced it first-hand or live in communities where it is widespread are therefore less likely to contest the practice – an argument supported by the patterns of acceptance and rejection between the study factors. As one Pennsylvania-based balanced rationalist explained:

> If you believe the gas company side of things that everything is going to be great, and you're going to be fabulously wealthy, and there's not going to be any environmental

> problems…and then somebody that believes what the [other side] is going to tell them…and then I think once you live with it for you know, eight or ten years and you realize that it's not really either end of that. It's much closer to the center. (sustainable/non-organic livestock farmer, Pennsylvania, F1 = .56)

As this passage demonstrates, some residents with first-hand knowledge of shale gas development on or near their land counterpoise their own experiences with the claims made by both pro- and anti-drilling stakeholders, and ultimately determine that neither narrative is wholly accurate.

Furthermore, of the participants whose Q sorts were either confounded between two factors or rendered insignificant at the 48 percent significance level, six of the nine were located in Pennsylvania (Appendix B.1). This trend provides additional evidence indicating a higher level of ambivalence or indecisiveness towards shale gas development among Pennsylvania-based participants. My reasoning for this interpretation relates to the role of the significance level used to determine which participants load onto the factors. Because I raised the significance level from 37 to 48 percent, the resulting factors are slightly "cleaner" or more idealized than they would be if they contained Q sorts from participants whose perspectives did not align with them quite so closely. Consequently, I interpret the higher prevalence of Pennsylvania-based participants among the insignificant and/or confounded Q sorts as deriving from the same spatial and temporal dynamics of familiarization and normalization that I outline above for balanced rationalists and skeptical individualists. Again, it is important to note that Q results are not intended to be generalizable to the broader population. However, this trend does highlight a potentially productive area for future research using surveys or other methods which can examine to what degree this trend bears out in the region as a whole.

The potential divergence between state residence and degree of polarization opens up further questions about the relationship between state-level hydraulic fracturing policy and

environmental subjectivity. As outlined in Chapter 2, Agrawal (2005) argues that changes in environmental governance lead to new forms of environmental subjectivity. Pennsylvania residents do appear to show a tendency towards accepting and normalizing shale gas development, thereby aligning with the state's stance towards extraction (although this stance is by no means universal among the study participants). However, the same cannot be said for New York-based residents in the study. Rather than displaying a trend where residents align with the state's ban on hydraulic fracturing, the top-down state ban instead appears to reify and harden pro-/anti-drilling polarization, as illustrated respectively by extraction enthusiasts and environmental protectionists.

An environmentality optics illuminates potentially productive lines of inquiry by examining how the divergent state regulatory landscapes of New York and Pennsylvania can differentially shape and influence circuits of knowledge generation and sharing, particularly relating to personal and experiential knowledge of natural gas extraction. Spatial proximity to extraction sites increases the likelihood that participants will have – or will believe that they have – accurate information about the process and its impacts, which they draw from their observations and experiences. However, spatial proximity and location alone do not determine whether participants are likely to have leased their subsurface mineral rights, and/or experienced drilling on their land. As the next section illustrates, leasing and drilling status articulates with spatial location to shape networks of knowledge production and circulation among stakeholders in the shale gas debate.

6.2.2 Leasing and drilling status

Each factor includes a mixture of participants who have leased their mineral rights, have not leased, or are unable to lease due to not owning their subsurface rights or not being in an area

that can support shale gas development. As Table 1 illustrates, extraction enthusiasts have the highest rate of participants who are currently or have previously leased. However, half or more participants who are environmental protectionists and skeptical individualists are currently or previously leased as well. Meanwhile, balanced rationalists have the lowest rate. This lower percentage is explained in part because a higher proportion of balanced rationalists either do not live in areas where oil and gas leasing is possible (e.g. Centre County in Pennsylvania, where Penn State University is located), or do not own large tracts of land and/or their mineral rights.

Table 6.2: Leasing status by factor

Leasing status	**F1 Balanced rationalists**	**F2 Environmental protectionists**	**F3 Extraction enthusiasts**	**F4 Skeptical individualists**
N	N=11	N=14	N=11	N=7
Currently or previously leased	3 (27 percent)	7 (50 percent)	7 (78 percent)	4 (57 percent)
Not leased	2 (18 percent)	4 (29 percent)	0 (0 percent)	2 (29 percent)
N/A*	6 (55 percent)	3 (21 percent)	2 (22 percent)	1 (14 percent)

*Do not own mineral rights and/or do not live in area where oil and gas extraction is feasible

However, leasing status is not necessarily an indication of whether a participant has directly experienced shale gas development and its impacts on their land. As Table 6.3 illustrates, there is considerable heterogeneity between participants who have leased and had their land drilled for unconventional or conventional oil and gas development, versus those who leased yet were not drilled at all. While extraction enthusiasts have the highest rate of participants who have leased their mineral rights, this number is skewed by the large proportion of New York-based individuals who leased prior to the enactment of New York's state-wide *de facto* ban on hydraulic fracturing. In terms of participants who have direct experiential

knowledge of drilling, skeptical individualists have the highest rate of all four factors – only two of the seven participants in this group have not directly experienced drilling on their land.

Table 6.3: Drilling status by factor

Drilling status	**F1 Balanced rationalists**	**F2 Environmental protectionists**	**F3 Extraction enthusiasts**	**F4 Skeptical individualists**
N	N=11	N=14	N=11	N=7
Leased and drilled (unconventional)	1 (9 percent)	1 (7 percent)	4 (36 percent)	3 (43 percent)
Leased and drilled (conventional)	1 (9 percent)	0 (0 percent)	0 (0 percent)	1 (14 percent)
Leased and not drilled	1 (9 percent)	5 (36 percent)	5 (46 percent)	0 (0 percent)
No mineral rights and drilled (unconventional or conventional)	0 (0 percent)	1 (7 percent)	0 (0 percent)	1 (14 percent)
Not leased or N/A	8 (73 percent)	7 (50 percent)	2 (18 percent)	2 (29 percent)

Together, the variables of location and leasing/drilling status illustrate how the act of generating and sharing experiential knowledge shapes circuits of discourse, with knowledge and information being a key discursive representation in the shale gas debate. As the narrative interpretations in Chapter 5 demonstrate, participants across all groups, but particularly extraction enthusiasts and environmental protectionists, leverage their first-hand knowledge of shale gas development and its impacts to support their claims of legitimacy and expertise. For example, multiple extraction enthusiasts living in New York – many of whom lived less than ten miles from the state border – employed their spatial proximity to Pennsylvania to reinforce their arguments, despite having not personally experienced oil and gas development on their land. Likewise, environmental protectionists (who are also concentrated in New York state) described traveling to sites like Dimock, Pennsylvania, the so-called "ground zero" of the anti-fracking

movement, to personally meet residents impacted by shale gas development in the region. Balanced rationalists and skeptical individualists, on the other hand, deployed their first-hand experiences with industry actors and the drilling process to argue that both claims of extreme environmental degradation and tremendous economic benefit failed to manifest over the long term.

Participants across all factors further operationalized experiential knowledge by deploying their experiences, as well as the experiences of others living in or near Pennsylvania, as evidence to support their claims or to undermine what they viewed as inaccurate allegations. In this way, both pro- and anti-drilling groups deployed experiential knowledge of shale gas development as a trusted source of information, making it a key discursive representation of shale gas development impacts for groups living farther away from extraction zones. For instance, one New York-based environmental protectionist described bringing speakers from Pennsylvania to share their negative experiences with the natural gas industry:

> There was a video that this guy near the Pittsburgh area had put online and he was pissed off about what they had done to his farm…We ended up getting him here to have a public forum and have him talk…He had started this service where he bought a water truck and was delivering water to all these neighbors because their water had been contaminated in Pennsylvania. We brought him here to speak. (organic orchardist, New York, F2 = .66)

The same participant also described traveling to Pennsylvania to take pictures of well pads, which she put into a PowerPoint presentation to circulate at town meetings and other discussions. In this way, she and other protectionists illustrate the common tactic of using first-hand encounters with fossil fuel extraction – whether their own, or those of others who experienced negative impacts from drilling – as a proxy for educating those who lack similar experiences. In addition to bringing in guest speakers, visual media such as documentaries, videos, and photographs – media which purport to capture first-hand experiences – became widely-circulated representational tools to translate experiential knowledge for later consumption.

Conversely, one extraction enthusiast in Pennsylvania directly linked his direct experiences with the natural gas industry to his ability to "dispel inaccuracies" about the drilling process:

> When someone asks you a question…Church (laughs), grocery store, Main Street, doesn't matter. Just being able to answer it, to dispel rumor, dispel inaccuracies, dispel rhetoric. And the role, I believe, of any elected official, is to make yourself available to as many resources that you can, that you are comfortable with what you offer…I really went to the industry and was very forthright with them. And we were invited into their community of information, I've stood in the housed area where the computers are, where there is sand and water being identified going down the shaft as they set the pipe and as they bend it and go down a mile and go out a mile and a half to two miles. I've stood in there and I've watched it happen. I've been there when the flowback water comes back. I've stood on the rack and the rig when the product was going in and the drill was being set. So that doesn't make me an authority by any means, but when the communications come back and they're not correct, at least give me an advantage [to say] no, let me share with you how it is. (conventional dairy farmer and county commissioner, Pennsylvania, F3 = .54)

As these passages illustrate, experiential knowledge about the oil and gas industry, drilling practices, and the impacts of extraction operate as a powerful discursive representational tool deployed by many stakeholders in the shale gas debate. The ability to produce and leverage these first-hand knowledges are shaped to a large degree by participants' spatial proximity to regions of shale gas development, as well as whether they have personally observed and/or experienced drilling on or near their land. Participants who do have these experiential knowledges are then able to circulate them through both formal and informal networks of information-sharing, whether those are public town hall-style forums, conversations at church, or social media.

Yet even though participants at both the pro- and anti-drilling extremes leverage this tactic to justify their claims to truth and expertise, there is disparity between factors in terms of which groups actually have a higher proportion of participants who have leased and drilled their mineral rights. Skeptical individualists have the highest rate overall. which is somewhat ironic given that they are the least likely group to say they are well-informed about shale gas

development. This finding supports the interpretation that participants who have personally experienced drilling are more likely to normalize its impacts – both positive and negative – over time.

6.2.3 Political orientation

The four factors display a strong pattern of alignment along political ideology and orientation (Table 4). Balanced rationalists are the only factor to include both conservative and liberal-identifying participants, and have the highest rate of moderate-identifying participants of all the factors. Environmental protectionists have the highest proportion of liberal participants, while neither extraction enthusiasts nor skeptical individualists include any liberal-identifying participants. Extraction enthusiasts are majority conservative, while skeptical individualists are majority libertarian or other.

Table 6.4: Political orientation by factor

Political Orientation	**F1 Balanced rationalists**	**F2 Environmental protectionists**	**F3 Extraction enthusiasts**	**F4 Skeptical individualists**
N	N=11	N=14	N=11	N=7
Liberal/left	5 (46 percent)	8 (57 percent)	0 (0 percent)	0 (0 percent)
Conservative/right	2 (18 percent)	0 (0 percent)	9 (82 percent)	3 (42 percent)
Moderate	4 (36 percent)*	3 (22 percent)	2 (18 percent)‡	0 (0 percent)
Libertarian	0 (0 percent)	2 (14 percent)	0 (0 percent)	2 (29 percent)
Other	0 (0 percent)	1 (7 percent)†	0 (0 percent)	2 (29 percent)§

*Two participants wrote “socially L, fiscally R”.
†This participant wrote “anti-capitalist”.
‡One participant wrote “fiscally L, socially R”.
§One participant wrote “radically conservative”; the other participant wrote “Politics & even the nation state are outdated”.

The role political orientation plays in mediating support or opposition towards shale gas development has been well-documented in the scholarly literature (Boudet et al., 2014; Choma et al., 2016; Clarke et al., 2016; Christenson et al., 2017; Howell et al., 2017). By and large, liberal-

identifying individuals tend to oppose shale gas development, while conservative-identifying individuals tend to support the practice – a finding supported to some extent by the trends outlined above. As Clarke et al. (2016) illustrate, this relationship is attenuated somewhat by spatial proximity to extraction: they find that the partisan divide between liberals and conservatives widens with increasing distance from regions of shale gas development. The authors posit that greater geographical distance requires people to make decisions based on conceptual or intangible considerations, such as political ideology, due to the "lack of cues such as experience with impacts, local media coverage, and interpersonal discussion" (305). However, living closer to extraction zones allows residents to triangulate between multiple sources of information, of which political ideology is one.

Political orientation and ideology is a powerful force mediating circuits of knowledge and discourse, such as by shaping what news and media sources are perceived as trustworthy. For instance, two New York-based extraction enthusiasts mentioned a right-wing political talk radio show out of Albany as a trusted venue. Another enthusiast, who was watching Fox News when I arrived at his home for the interview, told me that the New York Times began and perfected their "fake news" campaign with their shale gas coverage. Meanwhile, multiple environmental protectionists cited New York Times and National Public Radio – both of which are often coded as "left-leaning" media outlets – as trustworthy news sources. Two protectionists who had been active in the New York anti-fracking movement also recalled being interviewed by Fox News, and worrying that the reporter would "put their own spin on it" (horse boarder, New York, F2 = 0.82).

The question of political orientation further articulates with the divergent state-by-state regulatory contexts of New York and Pennsylvania. One balanced rationalist noted that

"politically in Pennsylvania, at the governor's level, both parties have been in favor of it…If you look at New York…I think it's pretty clear if you had a different political leader at the governor's level, would you have a different outcome? Likely" (Cooperative Extension educator, Pennsylvania, F1 = 0.60). As this passage hints, the liberal/conservative divide in Pennsylvania emerges more over the degree to which shale gas development should be regulated (e.g. whether to institute a state tax on the shale gas industry), rather than whether it should be allowed at all. In New York, on the other hand, shale gas development is perceived as a deeply politicized issue, with many participants (primarily extraction enthusiasts) describing it as a "political football" being held hostage to state-level political jockeying. Although participants in New York diverged sharply on whether or not they supported shale gas development, they did agree that the *de facto* state ban instituted by Governor Andrew Cuomo is inextricably entangled with state politics, which are deeply shaped by a rural/urban divide between a liberal "downstate" region and conservative "upstate" region. As a result, a majority of participants agreed that the hydraulic fracturing ban will last only as long as a Democrat remains in power.

6.2.4 Education

Unlike the strong trends delineating the factors by political orientation, the groups are more mixed in terms of their highest level of completed education. Balanced rationalists are the most highly educated group, with all participants having completed at least a college education, and a majority having completed a graduate degree. Environmental protectionists are the only other group to contain participants with PhDs, but they and the extraction enthusiasts have roughly the same proportion of participants with at least a college degree. In fact, over half of the participants in all of the factors have completed a Bachelor's or Master's degree.

Table 6.5: Highest level of education completed by factor

Educational level	**F1 Balanced rationalists**	**F2 Environmental protectionists**	**F3 Extraction enthusiasts**	**F4 Skeptical individualists**
N	N=11	N=14	N=11	N=7
High school	0 (0 percent)	5 (36 percent)	4 (36 percent)	3 (43 percent)
Bachelor's	4 (36 percent)	5 (36 percent)	5 (45 percent)	2 (29 percent)
Master's	4 (36 percent)	2 (14 percent)	2 (18 percent)	2 (29 percent)
Ph.D.	3 (27 percent)	2 (14 percent)	0 (0 percent)	0 (0 percent)

While the differences in completed education are not as starkly delineated between factors as those between political orientation, the optics of education articulate with drilling and leasing status to further reveal the contours of how politics of knowledge and expertise are operationalized within the shale gas debate. As the narrative interpretation outlines, balanced rationalists see themselves as the most qualified source of objective, accurate information in the shale gas debate. As one rationalist summarized, "Our role is again not to tell them you should believe this is good or believe this is evil, but if you're making comments or decisions, you understand the science behind what you're talking about. So we try to be advocates of the science, not advocating for any particular position in the dialogue. We try to advocate for the science, whatever that might be" (Cooperative Extension educator, Pennsylvania, F1 = 0.60). Interestingly, although most balanced rationalists did not directly experience drilling, many still distinguished between their personal knowledge of the industry and other less-informed perspectives. For example, one rationalist deployed this logic while discussing a contested study on methane emissions: "I could tell by reading the study that they actually hadn't been to a well pad…They were applying a multimillion cubic feet of natural gas production scenario to what would have been old equipment that you just didn't find on new shale wells…So you could tell

that the researcher hadn't even been to a site to know whether the assumptions that they were making were correct" (Cooperative Extension educator, Pennsylvania, F1 = 0.62).

The balanced rationalist perspective, in which they see themselves as the most credible source of information in the shale gas debate, is intimately linked to their position as highly educated professionals who have been formally trained in scientific knowledge production and communication. Their view of higher education as a measure of expertise further aligns with the finding that rationalists are less likely to have directly experienced drilling on their land (Section 6.2.2). Despite drawing on their own first-hand knowledge of drilling practices to some extent, rationalists were highly skeptical of claims of experiential knowledge made by both pro- and anti-drilling stakeholders. They frequently engaged in boundary-work to draw a distinction between objective, scientific information – which they claim to provide – and biased, anecdotal information. However, environmental protectionists and extraction enthusiasts both strongly resisted accusations that they were uneducated or biased about shale gas development, with both sides attempting to present their perspective as credible and backed up by science. For example, one environmental protectionist argued that he was skeptical about shale gas development *because* he was educated and had completed a bachelor's degree. Meanwhile, another participant who aligned with extractive enthusiasts said that "if you can look at it from a science point of view" it would help prevent "some of the fractiousness between the wants and don't wants" (conventional sheep farmer, New York, F3 = 0.49).

As this and prior sections illustrate, three of the study's factors – balanced rationalists, environmental protectionists, and extraction enthusiasts – make significant efforts to present their narratives as legitimate and credible. (Skeptical individualists are excluded because they are the only group not to see themselves as well-educated about shale gas development, or even as part

of the debate.) All three perspectives argue that their claims are supported by science, but as the most highly educated factor, balanced rationalists are able to leverage their formal education and training, as well as their command of the scholarly literature on shale gas development, as widely accepted indicators of expertise. On the other hand, environmental protectionists and extraction enthusiasts draw more upon experiential knowledge to support their claims (although they also cite studies and news media sources which align with their arguments). In this way, education and training have a significant influence on the sources of knowledge and information which participants access, circulate, and use. The ability to access and interpret scientific literature is also facilitated by the specialized education enjoyed by balanced rationalists. Lack of this educational training, on the other hand, could present an impediment for members of other factors.

6.2.5 Profession

The patterns of education among the factors intersects with participants' profession and employment. Balanced rationalists were overwhelmingly comprised by participants affiliated with each state's land grant college (LGC) and associated Cooperative Education System (CE). Meanwhile, the other three factors were all dominated by participants employed in the agricultural sector. Conversely, only one balanced rationalist was employed in agriculture. Interestingly, while three of the study's participants were employed both as farmers and Cooperative Extension educators, all three were rendered insignificant at the 48 percent level.

Table 6.6: Profession by factor

Profession	F1 Balanced rationalists	F2 Environmental protectionists	F3 Extraction enthusiasts	F4 Skeptical individualists
N	N=11	N=14	N=11	N=7
CES educator	6 (55 percent)	0 (0 percent)	0 (0 percent)	0 (0 percent)
Academic faculty	2 (18 percent)	2 (14 percent)	0 (0 percent)	0 (0 percent)
Policymaker	2 (18 percent)	0 (0 percent)	3 (27 percent)†	0 (0 percent)
Farmer	1 (9 percent)	11 (79 percent)	10 (91 percent)	7 (100 percent)
Other	0 (0 percent)	1 (7 percent)*	0 (0 percent)	0 (0 percent)

*This participant was employed at an environmental NGO which was highly involved in anti-fracking activism.
†Two participants were employed both as dairy farmers and municipal policymakers.

The patterns of employment and factor alignment highlight how institutional embeddedness plays a significant role in shaping participants' worldviews on shale gas development and agriculture. For example, one participant, who was affiliated with the environmental protectionist factor but had previously worked in Cooperative Extension, explained the influence that CE as an institution has on its employees: "I was tremendously disappointed in how they were trying to play this neutral party…I think that they're generally (pause) averse to making any kind of alarmist statements at all" (environmental NGO employee, New York, F2 = 0.79). On the other hand, farmers are embedded within the broader agricultural economic sector. As a result, their decision-making relative to shale gas development is intimately linked to how they think the process will impact their farmland, business, and agricultural practice.

6.2.6 Agricultural practice

Although educational protectionists, extraction enthusiasts, and skeptical individualists are all comprised primarily of farmers, a closer focus on agricultural practice reveals distinct patterns between each factor. Broadly, agricultural methods are often described as

"conventional" or "alternative," with each term conflating a suite of diverse practices that may or may not be practiced in tandem.[29] For example, "conventional" agriculture is generally associated with the use of chemical farm inputs (e.g. fertilizer, pesticides), mid- to large-scale production, distribution through regional or national markets, specialized commodity crop production, and grain or sileage feeding in the case of livestock. "Alternative" agriculture, on the other hand, tends to be associated with limited or no chemical input use, small- to mid-scale production, distribution through local and direct-marketing channels, diversified farming, and pastured livestock production.

Table 6.7 illustrates how farmers in each factor align along each of these domains. The patterns outlined in this section indicate that participants who employ multiple practices aligning with the suite of alternative agricultural methods tend to be less likely to support shale gas development. This pattern is consistent with research by Poulsen et al. (2018), who find that "sustainable" or alternative farmers are more likely to oppose shale gas development, while conventional farmers are more likely to support it. However, the presence of the skeptical individualist worldview, which transects these two clusters of agricultural practices, muddies this narrative somewhat.

[29] While the labels "conventional" and "alternative" are problematic in that they conflate a large number of disparate practices, I use them for the remainder of the dissertation as generic labels gesturing to the suite of practices they generally imply, while specifying particular agricultural practices when appropriate.

Table 6.7: Agricultural production methods by factor

Agricultural methods	F1 Balanced rationalists	F2 Environmental protectionists	F3 Extraction enthusiasts	F4 Skeptical individualists
N (Number of farms)	N=1	N=10	N=8	N=7
Chemical inputs:				
Limited or no chemical use [a]	1 (100 percent)	7 (70 percent)	2 (25 percent)	3 (43 percent) [f]
Chemical fertilizer/pesticide use	0 (0 percent)	2 (20 percent)	6 (75 percent)	5 (71 percent)
Distribution:				
Direct marketing [b]	1 (100 percent)	6 (60 percent)	3 (37 percent)	4 (57 percent)
Regional/national sales	0 (0 percent)	1 (10 percent)	3 (37 percent)	1 (14 percent)
Combination	0 (0 percent)	2 (20 percent)	2 (25 percent)	2 (29 percent)
Farm size:				
<50 acres	1 (100 percent)	5 (50 percent)	1 (13 percent)	0 (0 percent)
51 – 200 acres	0 (0 percent)	3 (30 percent)	3 (37 percent)	3 (43 percent)
201 – 500 acres	0 (0 percent)	2 (20 percent)	1 (13 percent)	4 (57 percent)
>500 acres	0 (0 percent)	0 (0 percent)	3 (37 percent)	0 (0 percent)
Range:	48 acres	4 – 350 acres	50 – 800 acres	85 - 387.5 acres
Average:	48 acres	94.5 acres	351 acres	225.2 acres
Median:	48 acres	50 acres	205 acres	255 acres
Mono-/Polyculture:				
Diversified farming	1 (100 percent)	9 (100 percent)	3 (37 percent)	4 (57 percent)
Commodity crops	0 (0 percent)	0 (0 percent)	4 (50 percent)	1 (14 percent)
Combination	0 (0 percent)	0 (0 percent)	1 (13 percent)	2 (29 percent)
Farm products:				
Dairy	0 (0 percent)	1 (10 percent)	3 (37 percent)	1 (14 percent)
Produce	0 (0 percent)	6 (60 percent)	0 (0 percent)	4 (57 percent)
Meats	1 (100 percent)	4 (40 percent)	3 (37 percent)	4 (57 percent)
Hay, grains	0 (0 percent)	1 (10 percent)	5 (62 percent)	3 (43 percent)
Other	0 (0 percent)	4 (40 percent) [c]	2 (25 percent) [d]	2 (29 percent)
Off-farm employment:				
Yes	0 (0 percent)	2 (20 percent)	4 (50 percent)	1 (14 percent) [g]
No	0 (0 percent)	5 (50 percent)	3 (37 percent) [e]	2 (29 percent)
Combination (one spouse works off-farm)	1 (100 percent)	3 (30 percent)	1 (13 percent)	4 (57 percent)
Average time farming	29 years	17.3 years Range: 5-33 years	33.2 years Range: 5-53 years	**38 years (check)** Range: 5.5-50 years
Livestock nutrition:	*N=1*	*N=5*	*N=6*	*N=5*
Pasture-based	1 (100 percent)	5 (100 percent)	1 (17 percent)	5 (100 percent)
Grain and sileage-based	0 (0 percent)	0 (0 percent)	1 (17 percent)	0 (0 percent)
Combination	0 (0 percent)	0 (0 percent)	4 (66 percent)	0 (0 percent)

[a] Includes organic, Certified Naturally Grown, permaculture, intensified rotational grazing, Animal Welfare Approved, or other practices which limit inputs purchased off-farm and/or prescribe certain practices (e.g. using chemical fertilizers/pesticides).

[b] Farmers markets, Community Supported Agriculture, local businesses and restaurants, U-pick, etc.
[c] Includes timber production on one farm, one vineyard, one cidery, and one horse boarding farm.
[d] Includes one farm selling wool and hides, and one farm selling soaps and other skincare products.
[e] Includes two participants who began farming after retirement from earlier careers.
[f] One farmer had certified organic hay and non-organic meat production.
[g] Factor includes two participants who began farming after retirement from earlier careers.

As Table 6.7 demonstrates, farms within each factor tend to cluster around a shared group of practices. Environmental protectionists are the closest to what would typically be labeled as alternative agricultural production. They have the highest proportion of farms that limit or use no chemical fertilizer or pesticide inputs, and all of the farmers with livestock used pasture-based grazing practices. Of all factors, advocates also had the smallest farms – the average farm size was 94.5 acres, with a median farm size of 50 acres. Half of protectionists' farms were 50 acres or less. As a group, protectionists also had been farming the shortest length of time, with an average of 17.3 years. Furthermore, the majority of protectionists relied on direct marketing for some or all of their sales, and all of advocates' farms practiced agricultural diversification.

Extraction enthusiasts, on the other hand, align most closely with what would generally be called industrial or conventional production. Of all factors they have the highest rates of chemical input use, grain and silage feeding for livestock, commodity crop production, and some or all distribution through regional and/or national markets. Furthermore, they have the largest average farm size at 351 acres, with three farms of more than 500 acres. It is important to note here that while these sizes are not considered large in the national context, the average farm size for the Twin Tiers counties included in this study is 180 acres. Thus, the farmers who affiliate as enthusiasts have farms that, in some cases, are several times larger than average for the region.

Like enthusiasts, skeptical individualists have farms that are larger than the regional average, with an average farm size of 225 acres. They also contained no farms of less than 50 acres. Additionally, only one individualist had certified organic land (although his livestock production business was not certified organic). Yet similar to the environmental protectionists, individualists employ a cluster of production practices that tend to be labeled as alternative: 86 percent of these farms employed direct marketing for some of all of their sales, and only one farm produced commodity crops. All individualists' farms with livestock were pasture-based, and many employed intensive rotational grazing practices. Although the majority of farms did not hold organic or similar certifications, three individualists described using practices which sought to limit pesticide and chemical fertilizer use as much as possible.

The patterns described here also mediate how farmers are situated within different discursive circuits, shaped by institutions which produce and share information pertaining to agricultural production. For instance, several participants aligned with the environmental protectionist and skeptical individualist worldview cited Joel Salatin, a widely-known libertarian farmer who advocates diversified production and intensive rotational grazing management, as a key source of information. Environmental protectionists also mentioned such institutions and sources of agricultural knowledge as the Pennsylvania Association of Sustainable Agriculture (PASA), Pennsylvania Certified Organic, the New York Organic Farming Association, Cornell Cooperative Extension, and Acres USA – all of which are institutions which circulate information about sustainable and organic farming methods via newsletters, magazines, workshops, social media, conferences, and online sources. On the other hand, extraction enthusiasts frequently cited the New York Farm Bureau and Cooperative Extension (both Penn State and Cornell) as sources of agricultural information, with one farmer also mentioning a

regional magazine called *Country Folks*. Skeptical individualists drew agricultural knowledge from a mixture of these sources, with participants mentioning New York Farm Bureau, Cooperative Extension, the Mid-Atlantic Vegetable Growers Association, PASA, and the Cornucopia Institute (an institution which promotes organic production).

As this section illustrates, farmers are differentially oriented within the agricultural sector, with participants employing diverse techniques to make a financially sustainable living. One further variable to note pertains to whether and how farmers' agricultural practices change over time. By and large, environmental advocates began their farming careers using the "alternative" production practices described above. Likewise, extraction enthusiasts mostly did not shift production practices over time (with two exceptions: a dairy farmer who shifted from conventional to organic dairying, and a married couple who shifted from conventional dairy to sheep farming, both in the early 2000s). However, five of the seven skeptical individualists described moving from "conventional" to employing some combination of "alternative" agricultural practices in response to changing conditions in the agricultural sector. Relatedly, enthusiasts and individualists both have an average of over 30 years spent working in farming, compared to the advocates' average of 17 years. Furthermore, the majority of enthusiasts and individualists are at least the second generation of their family to work their farm, compared to a minority of environmental protectionists. The temporal dynamic of agricultural production is discussed in more detail in the following chapter.

6.3 Institutional nodes and boundary objects

As the previous section illustrates, study participants align with the various factors along demographic patterns that illustrate the flows of knowledge, information, and other discursive representations. These flows are shaped and navigated by key institutions which seek to shape

the contours of these networks, thereby governing the production, circulation, and eventual application of knowledge and discourse. Institutions play a significant role in the production of environmental subjects by influencing the discursive representations to which stakeholders are exposed. For the remainder of the chapter, I highlight three key institutions, each of which has substantially shaped the discursive landscape upon which the shale gas debate continues to play out: 1) private property, which situates farmer-landowners as a significant "gatekeeping" stakeholder with access to the subsurface mineral frontier of shale gas; 2) the oil and gas industry, which seeks to hail farmer-landowners as pro-shale gas subjects in order to access the Marcellus formation; and 3) Cooperative Extension, which acts as a privileged information broker attempting to address the informational asymmetry between farmer-landowners and the natural gas industry. I also examine how the lease itself, as an instrument of knowledge codifying the relationship between landowner and industry stakeholders, intersects with and is leveraged within each of these institutional domains. In this way, I argue that the lease acts as a boundary object facilitating translation and circulations of discourse between these institutional actors.

6.3.1 Private Property Relations

The ability for farmer-landowners to lease their subsurface mineral rights is firmly predicated upon the formalized recognition of private property as an institution through state and legal apparatuses. Private property is a complex and multi-faceted social institution, deeply shaped through uneven topographies of power across time and space. In the present day, U.S. land tenure is primarily organized through private property relations, premised on the assumption "that the rights of the owner (to use, occupy, alienate, and so on) apply uniformly across and exclusively within this space…[and] to command all the resources within this designated space"

(Blomley, 2016, p. 594). From a legal standpoint, property does not consist of the physical space itself, but rather encompasses the social relations between two entities – in this case, between farmer-landowners and the natural gas industry. However, as Blomley (2016) explains, territory and property are not only frequently conflated, they are also "mutually constitutive. Property produces territory, polices its borders, frames its identities, and organizes its habits. Such territorializations, in turn, serve to materialize property in the socio-spatial world, while also obscuring many of its powerful relational effects" (p. 596). Thus, private property relations become inscribed upon landscapes even as the material space under question molds social relations.

Despite the tendency to normalize and depoliticize the production of private property relations, the process of territorializing space through private property relations is thoroughly implicated within contextually and historically contingent landscapes of power, knowledge, and violence. Unlike shale formations in other parts of the U.S., landowners in the Marcellus region are estimated to have a much lower rate of split estates – that is, parcels of land where the surface and subsurface rights are owned by separate parties (Fitzgerald, 2014). For farmer-landowners in the Twin Tiers, the increased likelihood of retaining their subsurface mineral rights have been produced through intersecting spatial and temporal dynamics. First, many – but by no means all – of the study participants own land that has been the property of their families for multiple generations, sometimes received directly from the U.S. government through indigenous dispossession. Such landowners are more likely to own their mineral rights. Second, because the Homestead Act of 1908 began retaining subsurface rights for the U.S. government, homesteads settled prior to 1908 are both more likely to own mineral rights and to be located in the eastern U.S. Finally, while New York and Pennsylvania states do have histories of extractive industry

such as timber, coal, and oil, the Twin Tiers region for the most part has historically been an agricultural region with relatively little subsurface extraction. States such as Oklahoma and Texas, where subsurface minerals have been widely developed for decades or longer, are estimated to have much higher split estate rates (ibid.).

Together, these historically contingent acts of (re)territorialization have produced farmer-landowners in the Twin Tiers region as subsurface mineral rights holders, establishing them as a key "gatekeeping" stakeholder group. Without their consent, produced by leasing their mineral rights, large swathes of subsurface shale gas formations remain unavailable for extraction and commodification. As one participant explained:

> A company is not going to be able to do the work unless they lease, and the leasing story really is a land game, so who has the most land, and that's where companies were most interested…[A] company wants to lease as much land as possible and a farmer that has 100 acres, for instance, is a whole lot easier to tie up more land in lease than 100 landowners that have an acre. (Cooperative Extension educator, Pennsylvania, F1 = 0.60)

In addition to their access to relatively large tracts of land, farms are also over-represented due to the physical characteristics of that land. Shale gas development is not as land-intensive as conventional drilling, given that a single well pad has a much larger sub-surface footprint. However, during its construction the well pad requires up to ten acres of space. Agricultural land is generally already cleared and leveled, making it a cheaper alternative than wooded regions where timber needs to be felled, or more urbanized regions with building development. Furthermore, the low population in rural agricultural areas ensures that the process, which generates large amounts of noise and light pollution, will not be as disruptive (Drohan et al., 2012).

Adding to the attractiveness of the Twin Tiers region for natural gas industry purposes, many farmers had already been hailed to some degree as "geological subjects" prior to the shale gas boom (Braun, 2000). Many of the participants interviewed in the study – particularly those

whose families have been living in the region for two or more generations – described shallow well gas leases on their farms going back decades or more, with their fathers or grandfathers leasing acreage for as little as one or two dollars an acre:

> In 2006, there was people going around trying to sign up people for gas leases. And there was a local man who tried to organize a group and got – what we took as an expert at the time – around to meetings and tried to get us the best deal and so on. Might know by the date, $45 an acre is what we signed up for. And 150 landowners, most in [our] township, some in neighboring townships, also signed up at the same time. And so of course, after that, the value went way, way up. But you know, as farmers, always struggling financially, and I know my dad had signed leases when I was a kid, for $1, $2 an acre, $3 an acre, whatever, and nothing had happened. And $45 an acre, well, that was $6,000…We needed to pay bills or whatever. But that's why we signed up. (conventional vegetable farmer, Pennsylvania, F4 = 0.59)

This passage illustrates two key ways in which private property relations are co-produced with and through circuits of information-sharing in the context of the Marcellus shale gas debate. First, the early days of the Marcellus boom were marked by a deep *informational asymmetry* between farmer-landowners, as the holders of subsurface mineral rights, and the oil and gas companies which sought to procure them. Farmers such as the participant cited above, who had little technical or legal knowledge to draw upon, instead leveraged their experiential knowledge of leasing and energy development to make informed decisions about this new round of leasing activity. Comparatively, per-acreage signing bonuses of $10, $20, or – in his case – $45 an acre were viewed early on as a decent return for signing a lease that, judging from previous experiences, would never actually be used to develop their mineral rights. As another participant explained, "We're like, what do they think is here? Didn't realize that there was actually something here…Every twenty years they come around and they give you enough money to buy groceries for a couple months and they never come back, so there's no reason not to sign" (grass-based livestock farmer, Pennsylvania, F1 = 0.56). Thus, leasing was viewed by early signers with

previous oil and gas industry experience as a low-risk endeavor, but with a relatively high financial reward.

Second, mineral rights holders began organizing into landowner coalitions as the informational asymmetry between landowners and industry stakeholders became more evident. As an institution explicitly designed to protect the interest of property owners, landowner coalitions articulate directly with the private property regime through which farmers emerge as mineral rights holders. Through these institutions, landowners collectively bargain with companies for more desirable terms than they might be able to get individually (Wildermuth, 2018). By consolidating their resources, landowner coalitions could hire lawyers or other specialists with legal expertise to consult on producing and negotiating a lease. Landowner coalitions in both New York and Pennsylvania sought to address the information asymmetry between landowners and industry by generating and circulating information about shale gas and the legalities of leasing. In New York particularly, numerous participants cited landowner coalitions as a key institutional resource employed for this purpose. One farmer who was active in his county and regional coalition summarized the services these groups provided, which ranged from organizing political action to educating farmer-landowners about leasing their mineral rights:

> Every county had their own coalition…But then we were all under the umbrella of the Joint Landowners Coalition in Binghamton, and that was sort of the main coalition, that tried to spearhead everything so everybody was sort of on the same page, when we had a debate. When we had to go to make speeches in Albany or do a demonstration in Albany, or go before the DEC [New York Department of Environmental Conservation] when we were, they were asking for feedback. They sort of coordinated the coalitions so everybody was on the same page…[Landowner coalitions are] concerned that the drilling industry uses the best practices, the best environmental practices, that the royalty payments are made on time and correctly, and figured correctly. What happens when the well is depleted, who's responsible for that. So there's a lot of issues that they educate the landowners, before you sign on the dotted line…When this first happened, we had hundreds of people come to meetings. You know, a lot of it was, there was a lot of

> interest in it, they thought that this was going to be a benefit. Quite a large benefit for a lot of farmers. (organic dairy farmer, New York, F3 = 0.54)

The observation that "hundreds of people" came to the landowner coalition meetings underscores the thirst for information, and the severity of informational disparity, that existed at the peak of leasing activity in the Marcellus Basin. Landowner coalition activity has somewhat subsided since the height of the shale gas boom, as well as the 2014 hydraulic fracturing ban in New York. However, some landowner coalitions have shifted towards advocating for landowners' rights around pipelines or other activities ancillary to shale gas development. For instance, in 2018 the Joint Landowners Coalition of New York actively campaigned during the midterm elections, endorsing candidates who promised to "restore" property rights in the Southern Tier for those whose right to lease their mineral rights had been "stolen" (JLCNY, 2019).

The act of leasing one's mineral rights serves a significant act of territorialization and spatialization in the context of the shale gas boom. The lease itself functions as a site where private property relations, property as physical territory, and the shale gas frontier are simultaneously and collectively co-produced. By negotiating and signing a contractual lease for their subsurface mineral rights, farmer-landowners actively perform their identity and subjectivity as mineral rights holders. The lease further serves as an artifact of knowledge and power that codifies the social relations between landowners and industry stakeholders, as well as the private property relations between landowners and their land. Farmers seek to leverage their lease as a tool which both facilitates and protects their agency within a highly disparate landscape, where they are frequently at a severe informational disadvantage relative to industry representatives – a disadvantage that, as the next section explains, industry stakeholders actively and continually seek to reinforce.

6.3.2 Oil and Gas Industry

The oil and gas industry is a crucial institution in the shale gas debate that seeks to shape flows of knowledge and discourse to serve its own ends – that is, to produce and commodify shale gas. As the previous section explains, the historically contingent landscape of social and power relations has situated farmer-landowners in the Marcellus Basin as key gate-keepers to the subsurface resource frontier of shale gas. In order to access and develop this frontier, the natural gas industry strives to hail farmers as pro-shale gas environmental subjects. Their efforts include a combination of tactics that shape and (re)produce unequal landscapes of knowledge and power in an attempt to control the production and circulation of information around shale gas development via hydraulic fracturing.

The oil and gas industry is active in spatializing land, thereby constructing shale gas as a resource. This process is primarily accomplished through the production and use of new technological developments which survey, measure, and otherwise render subsurface shale gas formations knowable and therefore extractable. For instance, participants frequently commented on noticing the presence of surveying equipment in the mid- to late 2000s, such as "thumper trucks" which conduct seismic testing to map mineral deposits. These surveying efforts, in addition to the technologies which enabled hydraulic fracturing and horizontal drilling processes, reframed shale gas trapped in deep subsurface rock formations as a natural resource available for development.

By rendering shale gas measurable, the natural gas industry also made it ownable. This act facilitated the transformation of the Marcellus from an inaccessible, abstract formation to a material and obtainable resource. In so doing, the gas industry also produced landowners positioned above the Marcellus formation as "geological subjects" who now had to make

decisions about the minerals they were learning that they owned (Braun, 2000). In this sense, all landowners who owned the subsurface mineral rights underneath their land were now hailed as shale gas subjects, whether or not they were in favor of drilling. From the perspective of the natural gas industry, the question became how to convince these landowners to grant access to what had emerged as a resource, now that it was technologically and economically feasible to extract.

As the previous section demonstrates, the early years of the shale gas debate were markedly characterized by a deep informational asymmetry between landowners and industry stakeholders. The natural gas industry was – and remains – active in (re)producing the unequal landscapes of knowledge and power upon which the shale gas debate has played out. I examine this process at two nodes of knowledge transfer between landowner and industry stakeholders: first, the interactions between land men and mineral rights holders, and second, the industry-run website Energy in Depth. These sites of knowledge distribution illustrate how the natural gas industry capitalizes upon, and seeks to reinforce, the relative ignorance of landowners and their own privileged form of technological expertise.

One of the few areas of agreement between all four factors in this study is that they all distrust the oil and gas industry to some extent. For the majority of participants – particularly farmer-landowners – the primary source of this distrust originated from their personal experiences with "land men." Land men are private contractors or company representatives who negotiate with landowners in order to acquire their mineral rights through a contractual lease. Nearly all of the landowners I interviewed who owned their subsurface mineral rights shared stories of being approached by land men, how they negotiated this process, and with what results. The following excerpt provides a representative example:

> We were all victims of a misguided line of the industry when it came in…They would say, boy, if you don't sign now, I don't know if the industry's going to be here. Yep, yep. Yeah, you got to [sign] it right now or it won't be here. Yeah, here's the number [the company is willing to pay]…And then you find out a couple days later that it wasn't really the number…and I heard this line a couple of times, that says, well, yeah, you could've done something different. Everything's negotiable. Well, you're told it's not. You know, you're threatened and you don't want to miss out on something because you're seeing and hearing these tremendous dollars. (conventional dairy farmer and county commissioner, Pennsylvania, F3 = 0.54)

Many participants described experiences where land men appeared to deliberately withhold or misrepresent important information, whether about the risks presented by the shale gas development process, how many of their neighbors had already signed a lease, the availability of legal protections and informational resources, or – as the passage above describes – the amount of financial remuneration available to landowners. To counteract what they view as deliberate obfuscation from the oil and gas industry, farmer-landowners frequently sought out other sources of information. For example, one farmer, observing that the industry representative "does his level best to make it appear that he's your friend," explained that "you're responsible as a landowner to get out to the meetings, to do some research, to hire a good lawyer or join a [landowner] group or both" (conventional vegetable farmer, Pennsylvania, F4 = 0.52). However, many of these informational sources require investments of money and time, which for many farmers can pose a significant barrier to access.

While the pervasive distrust described by participants presents some issues for the oil and gas industry by making landowners less likely to trust or seek out their information, leases – particularly those signed early in the shale boom – generally benefit the industry by codifying and hardening the uneven topographies of power and knowledge which characterize landowner-industry relations. One frequently cited example among participants was the common practice of industry deductions of "post-production costs," such as transportation, storage, or treatment, which are subsequently removed from landowners' royalties (Cusik and Sisk, 2018): "We were

not able to get a lease without…the gas company being able to take the deductions for their expenses. That's just simply not something that they will do anymore. There just virtually aren't any leases without the deductions" (conventional vegetable farmer, Pennsylvania, F4 = 0.52).

In this way, the lease serves as both artifact and enforcer of the social and power relations which produce informational and political asymmetries. Even for those landowners who seek out other sources of information such as hiring a legal professional, the natural gas industry still has the upper hand in terms of access to financial and informational resources not available to most farmers. Thus, some landowners questioned whether even protective language inserted into their lease would help them in the long run. One farmer, whose parents had signed a lease for conventional drilling in the late 1990s, stated that "you have no power" even if your lease contains protective clauses:

> We created, with the help of a lawyer and an environmental consultant, a very extensive and protective surface rights agreement. (pause) Which is one of the things the gas companies tell you is like well, we have these agreements, and so this is like how you know that we do things right, and we'll restore your property…And basically what happened was they were disregarding the surface rights agreement, because when it came down to it, it was just some project manager. He didn't give a shit. And a surface rights agreement is only as good as the money you have to sue to have it enforced. What's a contract? So they break the contract. Now what? Prove that they broke it. Okay. And if they say that they didn't? Now what? What's the next step? (organic orchardist, New York, F2 = 0.66)

As noted above, the oil and gas industry does financially benefit to some extent from companies that "got in there, screwed [the landowners], and got what they could and got out" (sustainable/non-organic livestock farmer, New York, F4 = 0.54). However, when widely circulated in the media, claims of mistreatment also cause potential problems for an industry attempting to bolster their "social license" (Cooperative Extension educator, Pennsylvania, F1 = 0.60) among area residents and the general public. A further issue, as several participants noted, is that the industry does not always acknowledge harm or potential problems. As one participant

explained, “It’s not completely safe. I think that was a mistake that the industry made, is that they made an illusion that there’s zero chance that anything would go wrong, and what’s the first thing that happens? There’s a big blow out, or there’s a spill, or there’s something catastrophic, goes wrong” (Cooperative Extension educator, Pennsylvania, F1 = 0.62).

In the face of an antagonistic public – particularly in the context of continuing anti-fracking campaigns in Pennsylvania, New York, and Ohio – the oil and gas industry seeks to counter what they argue are extremist and inaccurate claims made by anti-drilling activists. One institutional source where much of this work occurs is the Energy In Depth website (EID) – the second node of knowledge circulation examined here. Created by the Independent Petroleum Association of America (IPAA), an oil and gas industry trade group, EID describes itself as “a research, education and public outreach campaign focused on getting the facts out” about shale gas development via hydraulic fracturing (EID, 2019). It is worth noting that the IPAA represents an estimated 95% of all American oil and gas companies, including companies active in the Marcellus region such as Shell and Halliburton (Matz and Renfrew, 2015). Thus, EID essentially operates as a direct line of discursive and informational transfer from major oil and gas industry stakeholders to its readers.

Through an online platform, a major portion of EID’s efforts center around identifying and refuting academic research, news stories, or other media which present the natural gas industry in a negative light. For example, a blog post from March 2019 states that a recent study (Denham et al., 2019), which found that urinary and skin-related disease positively correlates with long-term unconventional drilling exposure, is “pushing instead an unexplained and loosely based connection” between drilling and negative health outcomes (Caldwell, 2019). The website also has an entire section devoted to “debunking” the anti-fracking documentary *Gasland*, in

which they "identify and correct some of the most egregious inaccuracies upon which the film is based" (EID, 2018). Furthermore, a search for "academic researcher" on the EID website reveals headlines such as "Discredited anti-fracking researcher pitching herself as 'academic neutral'" and "Researcher behind NY shale ban further reveals anti-fracking bias."

Together, these excerpts illustrate the boundary-work performed by EID to separate and delegitimize any research that represents shale gas development or the oil and gas industry unfavorably. At the same time, EID regularly promotes research in favor of shale gas drilling:

> It seems that almost every day new evidence emerges in support of hydraulic fracturing's clear record of environmental safety, as well as the positive impact the technology is having on America's economy. Yet there are still those who choose to rely on hyperbole rather than facts. (Eshelman, 2011)

This passage provides a representative example of how EID juxtaposes their own rational and fact-based information – based on "evidence" of a "clear record of environmental safety" – against the "hyperbole" of anti-drilling stakeholders. One study participant, whose research has been attacked on the EID website, argued that EID itself presents an illusion of scientific credibility even though the majority of its writers have little to no formal scientific training:

> These people know absolutely nothing about any of this stuff. Nothing. They're told by their masters, write derogatory things about [academic researchers]. Find ways to concatenate words that other people have said about him. Find ways to extract what he said out of context and connect various paragraphs and sentences and make him look like a fool. Do that and we'll pay you…Really, that's rational discussion? That's debate? Energy in Depth is an educational arm of the oil and gas industry? No, it's a public relations arm…And the thing is, nobody in Energy in Depth has any information in depth, or knowledge in depth. They're just paid PR hacks. Every once in a while, I'll do some background research. Who is this person? So this one, the woman…has a PhD from a reputable school in England, but in some area of economics…and it's not energy economics, or oil and gas economics, it was something totally unrelated to what she's allegedly doing, which is educating the public about answers to all those questions. (land grant college researcher, New York, F2 = 0.72)

Numerous academic researchers interviewed for this study noted that EID is often sought out – even by news media sources – "to find out what the industry position on something is" (land

grant college researcher, New York, F2 = 0.58). Thus, it would appear that EID has been successful at carving out a space within the shale gas landscape as a highly influential institutional node governing flows of information and discourse – despite, as the passage above claims, a dearth of scientific training or expertise among its writers.

Furthermore, this passage illustrates that all stakeholders within the contentious shale gas debate engage in projects of boundary-work which seek to showcase their work as rational and scientific, and counter-claims as unreasonable and biased. EID, and the oil and gas industry as a whole, is far from unique in that regard. However, the oil and gas industry benefits greatly from its enormous financial resources, which continue to create deeply unequal landscapes of knowledge and power which benefit them at the expense of farmer-landowners. By deploying the lease as a boundary object, the oil and gas industry re-draws boundaries so that farmer-landowners become part of a community of diverse stakeholders that together produce shale gas as a natural resource and commodity. Yet while the lease operates as a discursive representational tool facilitating the translation and circulation of environmental knowledge between heterogeneous social actors, it simultaneously acts to reify these uneven topographies of power through pervasive informational asymmetries.

6.3.3 Cooperative Extension Service

Like landowner coalitions, members of the Cooperative Extension service (CE) affiliated with the land grant institutions serving the Twin Tiers region have attempted to balance the deep asymmetries in knowledge and power between landowners and the oil and gas industry. CE, first established through the Smith-Lever Act in 1914, has long served as a key site in the negotiation of agricultural knowledge and expertise. CE was designed to work in tandem with the U.S. land grant college (LGC) system, with CE distributing the newest and most up-to-date agricultural

knowledge and technological developments produced at their affiliated LGCs to farmers and other interested stakeholders (Busch and Lacy, 1983; Seevers et al., 1997; Carolan, 2008; Henke, 2008; Trauger et al., 2010).

Together, LGC and CE merit examination as privileged networks of environmental knowledge production, circulation, and application in the context of the shale gas debate. Certain forms of knowledge and technology are produced by LGC researchers, to be communicated via CE educators to farmers and other knowledge consumers. These forms and artifacts of knowledge are legitimated due to their circulation along prescribed circuits (Henke and Gieryn, 2008). As Goldman (2011) writes, "[It] is through particular circulation processes that…certain knowledge constructs are considered more legitimate, correct, or "true" than others," the result of their passage "through various (social, political, economic, and academic) networks" (p. 204). Within the CES model, university researchers function as "expert" knowledge producers who develop technological fixes for agricultural production problems. Extension agents and educators, meanwhile, serve as distributors of that knowledge to non-specialists. Farmers, as the recipients of this top-down, linear model of knowledge transfer, choose whether and how to use CES information to adjust their agricultural practice.

As a historically privileged site of agricultural knowledge generation and communication, farmer-landowners were quick to turn to LGC and CE institutions for information when the first waves of leasing began (2005-06 for Pennsylvania, 2007-08 for New York). In this capacity, the Pennsylvania State University (Penn State) and Cornell University (Cornell), as the respective land grant institutions serving Pennsylvania and New York states, served as important site where flows of environmental knowledge regarding shale gas were, and continue to be, negotiated.

Many CE employees commented on the thirst for information about shale gas development that drove programming:

> Leasing workshops…That auditorium down there wasn't big enough to hold the audience that would come to a leasing workshop…We would cut it off at 200 people. I had never had such a response for a meeting. I would say leasing workshop, put a notice in the newspaper, and we had more capacity than ever…But given that there were companies that were coming in and leasing for thousands of dollars per acre, and that people were having that knock on their door by a land man, there were people who were saying how do I do this, or other people who were coming in and saying is this going to hurt me, all those types of things…There were phone calls every day, all day, dozens and dozens of phone calls. People would say this person knocked on my door. What should I do? What does this mean? How does that work? All those type of things. (Cooperative Extension educator, Pennsylvania, F1 = 0.72)

In this way, CE educators were situated between farmer-landowners and the oil and gas industry as key information brokers, acting as a kind of "boundary organization" (Cash, 2001; Breuer et al., 2010). Leasing workshops, which were in high demand in the early years of the Marcellus boom, were a major tool used by CE educators to help landowners address their lack of technical and legal knowledge.

The lease, as a boundary object which codifies of the balance of knowledge/power, formed a powerful instrument through which farmer-landowners felt they could exert their agency during a deeply unequal negotiation process. Yet without specialized knowledge and expertise, a lease can easily become a tool facilitating oppression and reifying disparities of power and influence. Many (but by no means all) of the study participants lauded CES for educating farmers in lease negotiation. As one farmer described, "I thought they'd done a good job. They put out information. They tried to keep to the facts…They did a lot of education at the time of not getting into a bad lease, because the gas operators, if they can hoodwink you and get you into a cheap lease, they'll do it to their benefit" (conventional dairy farmer, New York, F3 = 0.82).

It is interesting to note, however, that the driving force behind lease workshops and similar CE educational efforts came not from the CE institutions, but from farmer-landowners themselves. This "bottom-up" direction of knowledge transfer presented a disruption to the CE status quo, as one educator pointed out: "It felt much more like collective learning than top-down. I mean, it was really people in the county saying to people at Cornell, we need support. This is a big deal. And Cooperative Extension needs to get involved" (Cooperative Extension educator, New York, F1 = 0.55). In response, both Penn State and Cornell have made institutional changes to accommodate the perturbations of shale gas development. Cornell fielded a (now defunct) Natural Gas Resource Center, which sought to connect landowners with resources about shale gas development. According to one Cornell CE educator, "Probably the most tangible continuing thing that we did…was develop a roadshow, a PowerPoint with people to go out and deliver it in communities that wanted Cornell information" (Cooperative Extension educator, New York, F1 = 0.62). With the announcement of the state ban in 2014, however, the need for information about shale gas development and leasing has subsided in New York's southern tier.

Penn State, on the other hand, has seen more lasting changes in response to the shale gas boom. The institution now fields a Marcellus Shale Team whose work is explicitly intended to provide "unbiased information on all matters related to shale and natural gas" – although as one CE educator pointed out, the team has decreased from forty full-time personnel to two over the last decade ("Penn State Extension: Marcellus Shale and Natural Gas," 2017). In 2010 the school launched both the Marcellus Center for Outreach and Research (the university clearing house for shale gas-related research) and the Shale Training & Education Center (an entry level oil and gas industry job training program). In August 2015, the Penn State Law School renamed its

agricultural law center, now the "Center for Agricultural and Shale Law," to reflect "the interconnected nature of agricultural law and shale gas development" (Penn State News, 2015). As these shifts indicate, the changing needs of farmers in the region has resulted in significant institutional changes, demonstrating how the perturbations of shale gas development have (re)shaped the mission and aims of Penn State as a CE institution, complicating the LGC/CE narrative of top-down, linear knowledge transmission.

Yet, the perturbations of the shale gas boom extend far beyond Penn State CE alone, and are in the process of reshaping the university institution as a whole. It is important to examine this process against the context of the changing roles played by LGC and CE institutions as they seek to remain "relevant" – for as one participant noted during our interview, "You need something to feed the state programs to stay on the cutting edge and be relevant…I think it's about maintaining relevancy" (Cooperative Extension educator, Pennsylvania, F1 = 0.62). The contemporary outlook on agriculture and employment is vastly different from when Penn State and Cornell were first founded (1855 and 1865, respectively). In 1880, nearly 50% of the U.S. population was employed in agriculture, primarily through subsistence farming (Daly, 1981). Yet as of 2016, only 1.5% of the population lists agriculture as their primary source of employment (BLM, 2017).

With this in mind, it is perhaps not surprising that both Penn State and Cornell CES institutions have completed multi-year strategic planning and restructuring processes, each designed to condense their dozens of county extension offices into a much smaller number of extension "districts" (Trzaskos, 2013; Gill, 2017). Restructuring the institution is intended to increase its flexibility in the face of "a challenging economic climate and the evolving needs of

stakeholders and society" (Penn State Extension, n.d.). According to a January 2011 memo from then-Penn State Provost Rodney Erickson during the restructuring process,

> There are more voices both nationally and locally calling for change in traditional extension practices, administrative structures, and fiscal models. This is due to pressing budget challenges, coupled with evolving expectations for universities to respond to complex societal issues beyond cooperative extension's traditional agricultural expertise. (Erickson, 2011)

This language is similar to that used in a 2009 report by the Cornell College of Agriculture and Life Sciences, in which they announce a restructuring plan "to account for a possible cumulative reduction in revenues of 15%" ("Restructuring the College of Agriculture and Life Sciences," 2009).

The institutional restructuring of the agricultural departments and CES programs at Penn State and Cornell ties into broader trends of university neoliberalization, through which academic institutions "enact neoliberal economic assumptions by focusing on revenue generation, understanding students as customers, and construing their faculty as temporary service providers" (Saunders and Ramirez, 2017, p. 189). In enacting these neoliberal logics, LGC institutions are reacting to external economic incentives such as the dramatic withdrawal of state support over the past decade – creating the "pressing budget challenges" and "reduction in revenues" cited above in the schools' strategic planning documents.

Processes and networks of knowledge production, circulation, use, and erasure at university institutions are deeply embedded within these neoliberal exercises of power. Thus, it is difficult to separate the role played by Penn State and Cornell CE as key sites of knowledge generation and transfer from the neoliberal logics that shape and inform them. At present, it is not within the scope of this project to do so. Rather, for this dissertation it is necessary to situate their institutional behavior with regards to the shale gas debate within the broader shifts of power currently (re)shaping knowledge networks.

It is unlikely that anyone could have predicted the shale gas boom or that the sweeping changes to rural and agricultural landscapes it precipitated would occur during a period of widespread LGC/CE readjustment.[30] However, the choices made by Penn State CE took full advantage of the Marcellus boom, and its own privileged position as a trusted source of expertise, to pivot their institutional identity away from agriculture towards a broader rural development portfolio:

> Rural does not equal agriculture anymore as much, that there's a lot of other things happening in rural areas, like unconventional gas development, that is worthy of doing some things…and so how do you address those in a way that creates a capacity in the community for them to adapt to what comes next, and so I think Extension as a whole in the country is shifting towards that realization, and I think the research is finally getting to the point where everybody is realizing oh yeah, this makes a lot of sense and we need to do that. And so how each university implements that is totally different. (Cooperative Extension educator, Pennsylvania, F1 = 0.67)

Part of the process of institutional repositioning involves "redefining our products" (ibid.) – language that explicitly draws on neoliberal rhetoric of commoditization and consumption. These logics are further reproduced through the new district model which seeks to "streamline operations, improve efficiency, eliminate duplication and maximize productivity" ("District Model for Administrative Services," 2019).

Simultaneously, Penn State CE has sought to broaden their consumer base – a move that, again, is signaled through discursive changes such as the titles of "client relationship manager" and "business operations manager" which oversee the administration of each CE district. Again, the process of expanding the Penn State CE audience, as well as the "products" on offer, was arguably piloted through the institution's shale gas outreach and education programs:

> We generated the knowledge that we needed to fill the gaps and to be able to convey that to the public that was asking for it. The public defined as not just the [agricultural] public or the landowners, but legislators, regulators, all kinds of municipal officials, elected

[30] It is worth noting, however, that the original estimate that "fueled" the Marcellus Boom originated with Penn State geoscientist Terry Engelder, first published in 2008.

> officials of all types, so lots of different people, bankers, school board members, everybody – you know, you think of just the wide range of people that there were implications here for, we spoke to all of them lots of times… Eventually it spread across the border into New York, into Ohio, into West Virginia and into Maryland, to some degree. And so in that point in time we also expanded across the borders. We did a lot of programs in corresponding states, including in New York state. (Cooperative Extension educator, Pennsylvania, F1 = 0.60)

As this passage alludes, the act of restructuring has obliterated borders – geographically, between states and countries (several participants mentioned international visitors interested in shale gas education at Penn State), as well as between demographic domains by seeking to move "beyond" their historic agricultural focus.

Following on the heels of the university's central role as a key institutional site of knowledge governance in the shale gas debate, Penn State has recently instituted an effort to reinvent the institution as "The Energy University" of the U.S. (Engelder and Lash, 2008; Considine et al., 2010; Penn State College of Engineering, 2015). In a 2015 presentation to the Board of Trustees, Penn State President Eric J. Barron outlined an agenda to become "The Energy University" – a phrase currently being reproduced throughout university press releases, news articles, and outreach videos and publications (Falce, 2015, 2016; Penn State News, 2015; Penn State College of Engineering, 2015; "Engineering: The Energy Issue," 2017). The shift to "energy university" is also operationalized throughout the Penn State 2016-2020 Strategic Plan: the word "energy" appears sixteen times, while the word "agriculture" appears once (Penn State University, 2016). In 2016, the university even received an official commendation in the 114th Congressional Record from PA House Representative Glenn Thompson, who remarked:

> [Penn State] was founded as one of our Nation's first colleges of agricultural science. Now…the university is taking strides to become known as the energy university… I applaud the efforts of Penn State in striving to meet the needs of our energy sector, combining expertise in energy-related research, teaching, and service with contributions from leaders in the energy industries…Our energy industries, such as coal, natural gas, and oil, are vital to the history, heritage, and future of Pennsylvania. (114 Cong. Rec. H2945, 2016)

Thompson's remarks, codified within the national Congressional Record, formally enacts the ultimate purpose of Penn State's rebranding efforts, as described in the College of Agricultural Sciences 2011 academic restructuring proposal: to "achieve our vision as continued national and international prominence in our educational and research missions" (McPheron, 2011).

Viewed through an environmentality lens, Penn State's new identity as "the energy university" opens up new questions about institutional identity and subjectivity, by illustrating that farmer-landowner subjectivities were not the only actor (re)shaped in the wake of the shale gas boom. Rather, institutions such as Penn State Cooperative Extension also experience shifts and changes, alongside the farmer-landowners and other stakeholders it aims to serve. A question I would like to raise, but do not yet presume to answer, is whether institutions may be said to be interpellated as environmental subjects and to perform their own form of subjectivity. While it might be far-fetched to claim that shale gas was the cause of Penn State's shifting role as an LGC and CE institution, the institutional identity of "the energy university" has certainly been co-produced with and through the disturbances advanced by the Marcellus boom.

6.4 Conclusion

Through an environmentality optics, discourse operates as the medium facilitating the interplay and co-production between environmental knowledges, institutions, politics, and subjectivities. This chapter outlines the interconnections between discourse, knowledge, and institutional stakeholders, using Q study results to delineate the contours of the complex networks between them. In particular, knowledge and information function as key discursive representations in the context of the shale gas debate. Diverse institutional stakeholders seek govern the generation and circulation of environmental knowledge within these networks in order to control discursive flows to farmer-landowners as a key gatekeeping stakeholder group,

thereby shaping them as shale gas environmental subjects. Due to space constraints, I do not delve here into the institutions which seek to form *anti*-shale gas subjects – a gap which I aim to address in the future.

The issue of *politics* also emerges through the diverse acts of boundary-work performed by different institutions and stakeholder groups, who seek to establish and maintain positions of legitimacy, authority, and expertise within a highly contested and uneven landscape of power and knowledge. The next chapter takes a closer and more nuanced look at the politics of negotiating environmental subjectivity formation, conceptualized as the negotiations and contestations which emerge from the interplay of diverse, overlapping environmentalities. There, I deploy Fletcher's (2010) Foucauldian typology of environmentalities to analyze each factor as a form of environmental subjectivity interpellated with and through the confluence of multiple, competing, and sometimes contradictory exercises of power.

CHAPTER 7

COMPETING SHALE GAS ENVIRONMENTALITIES: HYBRID, PARTIAL, AND INCOMPLETE MULTI-SUBJECTIVITIES AT THE FARMING/SHALE GAS JUNCTURE

7.1 Introduction

The six domains outlined in the previous chapter – location, leasing status, political orientation, education, profession, and agricultural practice – illustrate how study participants are differentially embedded within institutional networks of information and knowledge sharing. These domains are distinct from one another, yet also articulate with each other, forming areas of tension and reinforcement. For example, education is strongly related to profession, thereby shaping circuits of credible, formal, and "expert" knowledge production and circulation, particularly for participants affiliated with the balanced rationalist factor. Location and leasing/drilling status are also closely linked to the production of experiential knowledge, as participants leverage their first-hand knowledge of drilling and its impacts, thereby continuously (re)inscribing boundaries between their own and opposing claims to legitimacy and truth.

These circuits of knowledge are also produced, circulated, and enacted with and through the medium of *discourse*, which serves as the channel through which representations of knowledge and information are conveyed. Discourse therefore acts as the medium facilitating interactions and exchanges between environmental knowledges, subjectivities, institutions, and politics. However, discourse is not value-free, nor is it (re)produced in a vacuum. Rather, the institutions governing flows of discourse – and thus, of knowledge, politics, and subjectivities –

are molded by the uneven topographies of power and politics upon which the debate over shale gas development plays out.

As outlined in Chapter 2, I view all study participants as always already formed as environmental subjects, in contrast to Agrawal's (2005) conceptualization of environmentality as only inculcating "positive engagement" with the environment. My approach argues that prior to the perturbations introduced through shale gas development, study participants have been hailed as environmental subjects through the "interplay" (Foucault, 2008) between diverse arts of environmental governance which promote preferred conduct. These modes of governance, as described in Fletcher's (2010) typology, include: 1) neoliberal environmentality, by imposing external economic incentives; 2) disciplinary environmentality, through internalized norms, ethics, and values; 3) sovereign environmentality, or the top-down enforcement of codified rules; and 4) truth environmentality, or the propagation of universal laws relating to what is considered "true" at a given time and place. Together, these layered exercises of environmental power and knowledge produce "multi-subjectivities" (O'Riordan et al., 2016), which I conceptualize here as the emergent subjectivities co-produced with and through concurrent, overlapping, and compounded environmentalities.

The co-production between diverse environmentalities is facilitated through technologies of government. As devices deployed with and through various environmentalities, the same technologies of government can be deployed by multiple institutions or used in divergent ways in service to creating desirable environmental subjectivities. The variables described above outline the contours of these overlapping environmentalities and illustrate how different technologies of government can facilitate exchanges at the junctures between them, thereby producing emergent multi-subjectivities. For example, the neoliberal governance tactic of technology treadmill

dynamics can be observed at play within both "conventional" and "alternative" modes of agricultural production, but with divergent results: classic treadmill dynamics incentivize industrial producers to produce more commodity, while reverse treadmill dynamics incentivize organic or other alternative producers to further restrict their market. In this way, competing and layered environmentalities can produce not only subjects who enact desired environmental behaviors, but also incomplete or hybrid subjectivities which arise from the push and pull of different, and sometimes opposing, exercises of power.

The multi-subjectivities produced from these layered environmentalities, and the interactions between them, condition participants to orient in certain ways towards shale gas development by pre-embedding them within particular institutional and political networks driving the propagation of discourse and knowledge. However, environmentalities and the multi-subjectivities they produce are not static: they are unstable and uneven, resulting in new sites of friction, resistance, and accord. Shale gas development maps onto these preexisting and shifting multi-subjectivities, potentially disturbing the interplay between previously established circuits of discourse, knowledge, and power. These shifting and contextually contingent networks prompt several questions, including: To what degree have the networks of environmental subjects, institutions, knowledge, politics, and discourses been disturbed by the introduction of shale gas development via hydraulic fracturing? How do the perturbations of shale gas development within and across myriad preexisting environmentalities open up new tensions, gaps, and synergies between diverse modes of environmental governance? Furthermore, what environmental subjectivities emerge as a result of these disturbances and shifts? And finally, to what degree does the economy/environment binary identified in the early stages of the study shape these networks, and with what environmental subjectivities emerging as a result?

As this last question highlights, the discursive context in which environmental subjects are hailed and formed plays a significant role in shaping landscapes of power and environmentality. The dichotomous economy/environment framing of the shale gas debate obscures the existence of partial, alternative, and hybrid subjectivities which do not neatly align with its pre-determined narratives. Furthermore, this and similar binary discourses shaping the shale gas debate conceal the complex tensions and negotiations occurring between and across multi-subjectivities, which produce equally complex and contradictory environmental subjects. However, I argue that viewing the shale gas debate through the layered co-existence between competing environmentalities, and the multi-subjectivities that result, can be deployed to deconstruct these binaries. In the following section I employ this approach to trace how the Q study factors emerge from the confluence of multiple sources of power, using Fletcher's (2010) Foucauldian framework to analyze the formation of shale gas subjectivities through neoliberal, disciplinary, sovereign, and truth environmentalities.

7.2 Factor 1: Balanced rationalists

Balanced rationalists are deeply influenced by their role as privileged generators and circulators of expert knowledge, which for most participants in this factor is a product of being embedded within the institutional structure of the neoliberal university. In this section, I illustrate how rationalists are formed as environmental subjects who support oil and gas industry interests by deconstructing the co-constituting discourses of neutrality and "balancing" the costs and benefits of shale gas development. The balanced rationalist worldview is best analyzed as an environmental subjectivity emerging from the confluence of reinforcing disciplinary and neoliberal environmentalities, produced with and through related land grant college (LGC) and Cooperative Extension (CE) institutions. As Fletcher (2010) notes, disciplinary

governmentalities may "construct the rational actors upon which neoliberal governmentality [can] then operate" (p. 176). In the case of balanced rationalists, a disciplinary environmentality through university institutions inculcates internalized ethics and norms via discourses of scientific neutrality and objectivity. These discourses are operationalized via a neoliberal environmentality, in which their expertise is deployed in service to capital as a means to support the continued development of shale gas resources in the Marcellus region, primarily through their roles as educators and researchers.

Through their institutional embeddedness, balanced rationalist subjects are interpellated and instilled with an ethic of objective impartiality. As outlined in Chapter 5, balanced rationalists see themselves as highly qualified to provide accurate and unbiased information about shale gas drilling to key stakeholders in the Marcellus area. This perception is a product of how rationalists are embedded within LGC and CE institutions as employees, graduates, and students. One participant who had previously worked for CE reflected on the process of being shaped as an unbiased scientist, saying, "They see themselves as educators, not advocates. That was definitely drilled into our heads strongly" (anti-drilling activist, New York, F2 = 0.79). This excerpt highlights the significant role of LGC and CE as key ideological apparatuses in the formation of balanced rationalists as environmental subjects. More so than any of the other factors, rationalists are entrenched within these institutions, which draw on, circulate, and (re)produce a discourse of neutrality to hail environmental subjects.

Balanced rationalists see their neutrality as foundational to their claims as the most credible source of information in the shale gas debate. The following passage shows neutrality discourse in action, demonstrating how rationalists view the association between impartiality and professional integrity:

> Months ago, there was a climate march in D.C., and there was quite a conversation around…should a scientist that's supposed to be neutral and just dealing with the science advocate for outcomes of the science that they're looking for…and there was quite an argument in the research community…So I would be in the camp that says scientists should be scientists and should be helping to develop the data and the information we need to make good policy, but we should stick to the science…The public views academics differently than they view government officials or environmental NGOs or industry players, they view us differently and they view us as separate and a more neutral voice, but if we start advocating for a particular position…I think it then drives perceptions that could be challenging, and it would drive your credibility to a different place. (Cooperative Extension educator, Pennsylvania, F1 = 0.60)

This quotation illustrates how balanced rationalists leverage neutrality discourse to establish their expertise and authority as scientists, researchers, and educators. In so doing, this passage performs an act of boundary-work (Gieryn, 1983) by demarcating their expertise, which rests upon a foundation of scientific detachment, from the information circulated by other potentially politically-motivated stakeholders such as policymakers, NGOs, and private industry. In this way, balanced rationalists attempt to carve out a space as trusted purveyors of up-to-date and reliable information within controversial and contested discussions such as the shale gas debate.

Prior to the introduction of shale gas development to the Marcellus Shale region, balanced rationalists were already formed as "neutral" scientist-subjects via the disciplinary governmentality of the LGC system in which they are employed and/or educated. The introduction of shale gas maps onto these pre-existing subject positions, shaping (but not determining) a form of neoliberal environmental subjectivity. As participants already situated within the CE framework as educators and researchers – or, in some cases, those receiving information as students and practitioners – balanced rationalists view and represent the arrival of shale gas through the frame of neutrality discourse. When asked where agricultural producers could go to find accurate information about shale gas, rationalists overwhelmingly endorsed universities and CE programs, citing their neutrality and reliance on scientific data as the reason

why they were the most trustworthy source of knowledge. According to one representative explanation:

> I would hope that most of the farmers would perceive us as a go-to resource. That we're not trying to convince them to lease or not lease or to participate or not participate in the shale gas, but we're trying to provide them the best information so that they can make the decisions that they need to make. (Cooperative Extension educator, Pennsylvania, F1 = 0.62)

As this passage indicates, rationalists' positions shifted to incorporate education, research, and training related to shale gas during the Marcellus boom. However, the introduction of shale gas development to the region did not fundamentally alter how rationalists were situated within the broader CE and LGC system, nor did it disturb their internalized norms of objectivity and neutrality. If anything, the perturbations of shale gas development reified the balanced rationalist position and worldview by positioning them as a key source of information for farmers and landowners in the early years of the shale gas debate. Rationalists see shale gas as just one topic among many for which they must provide responsible, fact-based educational sources to interested stakeholders. One participant summarized his role as an educator thus:

> [It's about] going back to the fundamentals and the lack of kind of a general base knowledge set and understanding set…so that when you get to a point where there's conflict, you can have an educated public that can have deliberative dialogue on an issue rather than automatically polarizing into us versus them. (Cooperative Extension educator, Pennsylvania, F1 = 0.67)

As this excerpt demonstrates, rationalists see their role as one of teaching residents to approach divisive topics, like shale gas, from a neutral standpoint – in short, reproducing and attempting to inculcate in others their own internalized values of impartiality and objectivity, seen as necessary for promoting "deliberative dialogue" in a calm and rational manner.

In this regard, balanced rationalists perform their disciplinary subjectivity by presenting scientific information in a "balanced" way, by presenting information without prescribing what they think stakeholders should do with it. For instance, one rationalist cited a program intended

to educate farmer-landowners with large acreage (i.e. upward of 100 acres) about the pros and cons of drilling:

> That program is probably one of the ones I was proudest of, because I had people who were very conservative farmers and someone who was a farmer and a fracktivist – both come up to me after the program and say, I learned stuff that was information and it was well-balanced. And I feel like that was my goal, and that should be the goal of extension" (Cooperative Extension educator, New York, F1 = 0.55)

This passage is representative of how many rationalists perceived the ideal goal of how knowledge about shale gas should be circulated: "well-balanced" information that is presented as being free of political or ideological bias. Such approaches illustrate how rationalists perform the disciplinary environmental subjectivity of neutrality, by presenting and circulating environmental knowledge as objective and based entirely on rigorous scientific data.

The labor of producing and circulating privileged forms of environmental knowledge also gestures to the ways in which balanced rationalists are formed by, and serve the interests of, neoliberal environmentality. Through their work, rationalists seek to establish "an educated public" – but their boundary-work delineates certain restrictions around what that "education" necessitates. Rationalists stop short of prescribing certain behaviors or outcomes, but their underlying expectation is that, through education, they are shaping rational actors who will make the "correct" decision as long as they have access to "good" – here, meaning fact-based and therefore credible – information. While rationalists are careful not to say that they are "for" or "against" shale gas development, their educational focus is on helping landowners, policymakers, industry actors, and other interest groups integrate shale gas development into the region for long-term economic stability. Thus, balanced rationalists enact a form of neoliberal environmental subjectivity as key source of privileged knowledge production and transfer, processes which in turn seek to form the recipients of this knowledge as neoliberal

environmental subjects who will lease their mineral rights for shale gas commodification as the "rational" and economically responsible choice.

For balanced rationalists, this performance of neoliberal environmentality can be observed at play within the discursive trope of balancing the costs and benefits of shale gas development. The following passage provides a representative example of how rationalists discuss shale gas development in these terms:

> The development of natural gas itself is really big and complex, and everything from first breaking ground through to the consumer, there are impacts all along the way of whatever energy system we have, whether it's oil or natural gas or coal or wind and solar. I mean, I tend to think about it as an energy portfolio, and we have choices to make about that portfolio, and so to ban one limits our choices. (land grant college researcher, Pennsylvania, F1 = 0.60)

Speaking of shale gas development in this way, as part of a diverse "energy portfolio" which seeks to carefully balance the costs and benefits of multiple energy sources, frames the question of shale gas in economic terms. By positing that the costs of banning shale gas development altogether would outweigh its economic and environmental benefits, balanced rationalists respond to and reproduce these market logics, thereby performing a form of neoliberal environmental subjectivity.

The cues of neoliberal environmentality as represented through the cost-benefit discourse are rendered especially clear within the narrative of shale gas as a "bridge fuel" – that is, a fuel that functions as a climate change mitigation strategy by facilitating the transition from fossil fuels to renewable energy. At its foundation is the claim that shale gas "burns cleaner" than other fossil fuels such as coal and oil, thereby releasing fewer greenhouse gases into the atmosphere. When engaging the bridge fuel narrative, rationalists engage a cost-benefit framing by placing what they view as temporary, localized costs of shale gas development against the long-term, global benefits of systemic emissions reductions:

> As a global citizen, I see some climate change benefits from doing natural gas. Is it a perfect climate change solution? Absolutely not. It is still a fossil fuel, and it still takes a lot of energy to get that fuel out of the ground. But I think there are some opportunities…It just buys us time to figure out how to do it better. Are we actually doing that? No. (laughs) So again, it's the how. To me, it's not in and of itself an inherent good or evil, it's how we set up our system to do it right…You know, it's better than coal…Not just for climate change issues, but for human and environmental health. (land grant college researcher, Pennsylvania, F1 = 0.60)

As this passage illustrates, balanced rationalists believe that the cost-benefit ratio works more to our advantage with shale gas than it does with other fossil fuels.

From a balanced rationalist perspective, shale gas is above all else a pragmatic choice – it is neither "an inherent good or evil," but an apolitical tool. Their focus on quantifiable cost-benefit analysis also provides rationalists with an apparently impartial means of measuring the pros and cons of shale gas, appealing to their internalized norms of objectivity and impartiality in a further intersection of their disciplinary and neoliberal subjectivities. As a result, rationalists argue that, when viewed objectively through the economic lens of a cost-benefit analysis, it is clear that supporting shale gas development is the responsible and practical choice.

As this section demonstrates, deconstructing the interlocking discourses of "neutrality" and "balance" reveals how balanced rationalists emerge from distinct yet complimentary disciplinary and neoliberal environmentalities. Being embedded within the institutional infrastructure of the LGC/CE university system, which has previously shaped rationalists through internalized norms of impartiality and objectivity, lays the groundwork for their later interpellation as shale gas subjects. Rationalists primarily support the commodification of shale gas development through their role as privileged generators and circulators of knowledge relative to shale gas, while their ethic of neutrality constrain what they can and cannot say about shale gas and its impacts. However, conceptualizing and framing shale gas development through seemingly "neutral" market-based frames obscures other means of viewing and relating to shale

gas development, such as moral and ethical valuation. This question of the morality of shale as development is a central concern of the environmental protectionist worldview, as the next section demonstrates.

7.3 Factor 2: Environmental protectionists

Environmental protectionists' subjectivity emerges out of the co-production of disciplinary, truth, and neoliberal environmentalities as outlined by Fletcher's (2010) Foucauldian schema. Like balanced rationalists, protectionists are always already formed as environmental subjects: prior to the introduction of shale gas development, protectionists (who are majority farmers) are interpellated as farmer-subjects whose environmental practices are informed through the confluence of multiple environmentalities. While the introduction of shale gas development perturbed these frameworks somewhat, I argue that protectionists' pre-existing discourse of "good" farming practice, which is predicated upon a particular way of conceptualizing human-environment relations, set the stage for their eventual resistance towards shale gas development.

Environmental protectionists have a definitive idea of what it means to be a "good" farmer, as outlined in detail in Chapter 5. This conceptualization – which views prioritizing environmental stewardship and community well-being above individual economic benefit – is a product of interlocking, and sometimes contradictory, exercises of power. First, the definition of "good" farming itself as prioritizing environmental protection reflects powerful internalized principles around safeguarding environmental resources from harmful human action – evidence of disciplinary environmentality at work. These disciplinary norms directly and deeply inform protectionists' agricultural practices, as one participant explained: "Sustainable farming methods are the cornerstone of caring for our environment. Reusing our resources, not using chemicals,

and I think farming is the ultimate act of environmental stewardship" (diversified organic farmer, New York, F2 = 0.5284). Similarly, another protectionist argued that "This is the answer for farming. We have to rebuild the local food system. We have to practice regenerative agriculture. We can't rely on chemicals and fertilizer" (organic orchardist, New York, F2 = 0.66). As these passages illustrate, protectionists define "environmental stewardship" in a particular way, which for most participants means reducing or eliminating chemical inputs like pesticides and fertilizers, and remaining locally embedded through direct marketing and local sales (Table 6.7). As summarized in Chapter 6, (Section 6.2.6), all protectionist farmers employ some combination of "alternative" agricultural practices, thereby performing their disciplinary environmental subjectivity. Furthermore, while protectionists on average have been farming less time than extraction enthusiasts and skeptical individualists (17 years compared to 33 and 38 years respectively), they started their farming careers using alternative practices.

As the passage above alludes, the choice to enter farming is itself a choice shaped by a disciplinary environmental subjectivity that views farming as "the ultimate act of environmental stewardship." Environmental protectionists describe coming to perform this mode of environmental subjectivity through diverse paths. For instance, one organic dairy farmer explained that her choice to use organic practices emerged from not wanting to sell a product that she was not willing to feed her own family. This was a common thread among farmers who began their farm businesses with young children – they describe wanting to raise children "in the country" to learn how to "grow their own food" (diversified organic farmer, New York). Another protectionist described "having a young mind radicalized by some old professors" while in college, by taking classes "about the food system and factory farming and just getting woken up to that side of things and educated" (permaculturist produce farmer, New York, F2 = 0.74). Still

others drew on fond memories of family members' farms, such as a protectionist who recalled visiting her aunt's farm where "they had a plum tree and a cherry tree, and I thought there could be nothing finer than having your own cherry tree to gorge yourself on as much fruit as you could possibly eat, and no one tell you that that was enough" (diversified perennial crop farmer, Pennsylvania, F2 = 0.76).

For protectionists, choosing to shift to farming from – or in addition to – other careers is therefore a deliberate choice, made in order to nourish the their environmental connection. These choices are further shaped and reinforced through a truth environmentality that views humans as inherently connected to nature. As the following excerpt explains, "I firmly believe that as humans, as beings on this earth, we are not above the laws of nature. We are not exempt…A lot of problems that we see today in society, in health, in well-being, a lot can be traced to what people are calling nature deficit disorder. Most people are not connected to the world around them" (permaculturist produce farmer, New York, 0.74). Environmental protectionists view the "connection" between humans and nature described here as elemental and intrinsic. Their farming practice, and specifically their advocacy of alternative production methods, also enacts a truth environmentality in that they seek to connect others to the land with and through their farm. As one protectionist explained, "Our goal is to bring people closer to the earth, to know how their food is, where their food comes from" (diversified organic farmer, New York, F1 = 0.53). The act of farming, and using their farms and agricultural products as a means of educating customers about the environment, shows how protectionists' subjectivities meld both disciplinary and truth environmentalities: similar to balanced rationalists, protectionists educate their customers in order to hail them as certain kinds of environmental subjects who purchase

local, organic, etc. foods in order to support "good" farming and to nurture stronger connections to nature.

By hailing and reproducing customers who will support their farming philosophy, environmental protectionists illustrate a third facet shaping their environmental subjectivities: neoliberal environmentality. Protectionists might start farming in response to powerful discourses around "good" farming and the importance of nature in their lives, but their farms are also businesses. As a result, protectionists' subjectivities are also shaped in response to external economic forces, which can both reinforce and compete with exercises of power stemming from the afore-mentioned disciplinary and truth. Protectionists perform a synergistic neoliberal subjectivity in that the alternative farming practices through which they enact disciplinary and truth subject positions position them to take advantage of reverse technology treadmill dynamics. "Niche" farming methods employed by protectionists – including organic or similar certifications, innovative direct-to-consumer marketing approaches, and unique products – enable them to capture added value without resorting to increased production, as in the classic technology treadmill. Thus, some protectionists are able to harmonize the push-and-pull of disciplinary, truth, and neoliberal environmentalities by capitalizing on such practices without feeling they are compromising their ethics or philosophies.

However, some environmental protectionists do navigate tensions between these diverse subjectivities, particularly when their disciplinary and truth ideals come into conflict with market imperatives. For instance, one protectionist explained that he was ending his local CSA that year, because he was not able to make enough money to support the farm without subsidizing it through his labor:

> The foolish thing about the vision was that I was going to start a vegetable farm that was going to finance this long term tree based permaculture dream, but the problem is that it's

> really hard to make money in annual agriculture, especially in the largest and 16th poorest county of 84 or 82, whatever it is, in New York state. But I was young and idealistic at the time (laughs). (permaculturist produce farmer, New York, F2 = 0.74)

Later in the interview, this protectionist explained that he was unwilling to drive several hours to urban centers like Rochester or Ithaca, where he could command a higher CSA price, because it conflicted with his ideals concerning the radical politics of local food production. However, this protectionist's choice to stop his CSA rather than undermine his "idealistic" philosophy demonstrates the power of "good" farming discourse, which forms the foundation of the protectionist subjectivity. For protectionists, the added value of "alternative" farming is what allows them to pursue their passion, as opposed to those farmers who pursue alternative or niche farming solely as a business decision (Guthman, 2004). For protectionists, disciplinary norms and values thus constitute a deeper, more fundamental aspect of their environmental subjectivity than neoliberal exercises of power.

For the most part, the introduction of shale gas development did not radically disturb the layered environmentality topographies through which environmental protectionists are formed as environmental subjects. Rather, shale gas development has mapped onto this pre-existing landscape, reifying some relationships between diverse arts of environmental governance, while altering others. How protectionists are positioned within these topographies, as well as the institutional and discursive networks in which they are situated, prime them to resist shale gas development as a risk to shared environmental resources. A particularly prominent thread throughout the interviews illustrated that the idea of leasing one's mineral rights for economic gain diametrically opposes how protectionists conceptualize, represent, and enact "good" farming practice, as the following excerpt demonstrates:

> P: Early on it just seemed unseemly to me. It seemed like, oh well, pennies from heaven, everybody's winning the lottery…It just seemed so unfarmer-like. (laughter)

> I: Can you explain what you mean by that a little bit more?
>
> P: (sighs)…Concern for the land. Concern for your neighbor…My wife is from, her family's from Southern Indiana, okay. Her mother grew up on a farm…It was tough living. Even though they were on really rich land, and they had a pretty large farm. They weren't poor by farmer standards, but they certainly weren't wealthy, but their main concern was stewardship of the land. Money was only important to the extent that you made a good living. So what makes you think that suddenly you have the right to be a multi-millionaire on the backs of somebody else? That's, to me, slimy. (land grant college researcher, New York, F2 = 0.72)

This passage illustrates how the protectionists' disciplinary subjectivity competes with neoliberal exercises of power in the context of shale gas development. The internalized collectivist ethos shared by protectionists frames the idea of financially benefiting from the collectively shared environmental and social costs of fracking as immoral and repugnant. Disciplinary discourses of "good" farming – exemplified as valuing "concern for the land [and] your neighbor" – are juxtaposed against the "slimy" and "unseemly" act of bending to external economic pressures and leasing one's mineral rights.

Environmental protectionists, who see the decision to support or ban fracking as a deeply moral question encompassing the potential for widespread environmental consequences, did not scruple to curtail relationships with those who they saw as making a greedy decision driven by money rather than ethical concerns. These discursive representations of the powerful inner values driving environmental protectionists' resistance towards shale gas acted as a divisive force within the shale gas debate, as pro-drilling stakeholders resented being treated as somehow unprincipled or unethical. Numerous participants from other factors referenced the disciplinary tactics which emerged from protectionists' deeply held moral convictions, which they argued divided communities along pro- and anti-fracking lines. For example, one organic farmer who supports shale gas development reminisced, "I was real active in the organic community when I first got in it. And then I got involved with this natural gas situation, and there was a real conflict

there…Cause most of the organic farmers don't want natural gas development in this state…And it's been hard because I've lost some friends over this issue" (organic dairy farmer, New York, F3 = 0.54). This and similar recollections illustrate this performative aspect of protectionists environmental subjectivity during the shale gas debate.

In addition to reproducing a disciplinary environmentality, environmental protectionists are also subjected to disciplinary tactics, which are co-produced alongside neoliberal logics to resist shale gas development. These exercises of power emanate from the customers they helped to educate and the institutions, such as food co-ops or organic certifiers, in which they are embedded:

> So much of how we sell our product is it's not just the product, you know? We don't sell bulk milk into a tanker. We sell a story about our land and a product that tells a story about the land, and we give people like a look into what we do. We constantly have people from the trade, beverage directors from New York City, our distributor or whoever, people come here all the time. And I think it would be next to impossible to like bring them here and have it be an industrial site, and have them go back and sell it to customers that are looking for an authentic product, you know? And say, yeah, this came from an industrial site, you know? (laughs) Here it is. Drink up. (organic orchardist, New York, F2 = 0.66)

As this protectionist describes, institutions like the beverage industry (indicated here by trade representatives and product distributors) are a key source of intersecting disciplinary and neoliberal environmentalities, as customers' internalized values lead them to threaten withholding support from farms who act against these shared values. As a result, protectionists worry that being located near drilling sites could negatively impact their business as environmentally-minded customers and businesses may refuse to buy from them. Traces of a truth environmentality can also be observed here through the language of "authenticity." From this perspective, a farm's product acts as a conduit from the farm itself to the product's consumer, becoming a vehicle for connecting customers to nature. By arguing that they "don't sell bulk milk into a tanker," protectionists demarcate their farms and agricultural methods from

what they view as the environmentally destructive practices of intensive, industrial farming. However, the same logic can spell economic doom for their farm businesses, if the institutions shaping agricultural markets or their customers worry that the "authentic" farm has shifted from being in tune with nature to instead become "an industrial site."

Through the co-production of disciplinary and neoliberal environmentalities, environmental protectionists therefore emerge as anti-shale gas subjects, producing and performing a subjectivity of resistance towards the shale gas industry. As noted in Chapter 6 (Section 6.2.1), protectionists are primarily located in New York state, which in 2014 banned hydraulic fracturing. However, it was active resistance of New York-based protectionists, through a scalar strategy of passing enough municipal bans and moratoria throughout the Southern Tier to create a *de facto* state ban, that arguably made the ban a reality. The protectionist subjectivity of resistance is strongly shaped by informal information sharing networks, described in Chapter 5, which protectionists cite as key notes that facilitate knowledge circulation – particularly experiential and anecdotal knowledge, which emerge as privileged sources of trusted discourse.

Informal knowledge networks function as technologies of resistance among environmental protectionists (Birkenholtz, 2009) by enabling the flow of information and discourse, and therefore facilitating the formation of other anti-shale gas environmental subjects. For example, one protectionist cited the "List of the Harmed," an online website run by a volunteer anti-drilling activist who links news articles citing individuals who claim to have been personally harmed by fracking:

> It's just a compilation of what people who have gone public saying their problems were. So there's a preponderance of the evidence. There's just too many people that don't have anything to gain by coming out and saying that their water was contaminated, or their water was fine, gas well goes in, water's not fine anymore. It's – there's just too much of

> it. So they can call it anecdotal, but I like to call it the preponderance of the evidence. (diversified perennial crop farmer, Pennsylvania, F2 = 0.79)

As this participant describes, protectionists leverage the personal and experiential knowledges of those impacted by shale gas development to establish their own expertise and credibility. By circulating these stories through sources like the List of the Harmed, or via widely-viewed media such as documentaries (e.g. *Gasland*), protectionists deploy the first-hand knowledge of those negatively impacted by shale gas to interpellate other anti-shale gas environmental subjects.

In this way, environmental protectionists perform acts of boundary-work seek to establish experiential and anecdotal knowledge as legitimate sources of information. Acknowledging such first-hand experiences as credible and trustworthy therefore constitutes a key aspect of performing, and reproducing, protectionist environmental subjectivity. Protectionists frame experiential knowledge as credible and plausible using the language of authenticity. By arguing that "there's just too much" anecdotal evidence for there not to be an underlying problem, environmental protectionists use personal stories as key representations to perform their own boundary-work in opposition to the formally recognized expertise and knowledge promoted by balanced rationalists (see also Section 6.2.2). In this way, circuits of knowledge overlap and are co-constituted alongside the flow of discursive representations.

As illustrated here, environmental protectionists have emerged as anti-shale gas subjects from overlapping disciplinary, neoliberal, and truth environmentalities. The complex interactions between these environmentalities illustrate a seemingly contradictory effects of the perturbances of shale gas development upon protectionist environmental subjectivities. On the one hand, shale gas development failed to substantively change how protectionists view and value the environment, how they conceptualize "good" farming practice, or how they are situated within institutional networks of discourse and knowledge circulation. Rather, the introduction of the

process in the late 2000s mapped onto a previously held ethos of safeguarding collective environmental resources, and further articulated with representations of nature as a fundamentally pristine resource that must be shielded from destructive human action. From this perspective, shale gas has failed to radically disturb the environmentality networks through which protectionists emerge as environmental subjects.

Yet, environmental protectionists view shale gas development as posing significant and widespread risks to nature and the agricultural landscape. In response to the perception that they would have little to no agency against exercises of power generated by the oil and gas industry, protectionists do emerge as anti-shale gas environmental subjects, mobilizing around the specific issue of shale gas development. From this perspective, protectionists have been interpellated through an environmentality of resistance to shale gas, which draws on and reinforces their deeply held convictions, values, and politics. However, the 2014 New York state ban introduces a relatively new perturbation to these frameworks. Without the looming threat of hydraulic fracturing, environmental protectionists reported being less acutely concerned about shale gas development. While some remained active in anti-fracking resistance – particularly those living in Pennsylvania – protectionists living in New York have disbanded somewhat in terms of performing a coherent anti-gas subjectivity. One indication of this change was evident through yard signage. When I visited the Twin Tiers region for pilot fieldwork in Summer 2015, it was common to see various yard signs reading "New Yorkers Against Natural Gas," or the antithesis, "Friends of Natural Gas." By the time I returned for fieldwork in Fall 2017, few yard signs remained. However, many protectionists mentioned shifting their activism to other domains. For instance, one farmer-activist protectionist described transferring her focus to promoting solar energy in the region. Other protectionists noted that, although hydraulic fracturing is banned,

active resistance towards other aspects of shale gas development is ongoing. A similar trend can be seen in the following section, except in reverse: where the New York *de facto* ban has relaxed protectionists' concern somewhat, extraction enthusiasts have instead coalesced around the contention that they are being denied their private property rights.

7.4 Factor 3: Extraction enthusiasts

From a discursive standpoint, extraction enthusiasts come closest to embodying a pro-shale gas environmental subjectivity. Of all factors, they are the most adamant in their support of shale gas development, which they argue can help "save family farms." I deconstruct this narrative as co-produced at the juncture of neoliberal, disciplinary, and sovereign environmentalities which together interpellate extraction enthusiasts as pro-drilling environmental subjects. Similar to environmental protectionists, enthusiasts, who are majority farmers, are always already formed as agricultural subjects. Also like protectionists, enthusiast subjectivity is deeply shaped by powerful disciplinary norms around what constitutes "good" farming practice. However, I argue that enthusiasts are differentially situated within networks of discourse, knowledge, and institutions relative to protectionists, which as a result has shaped their environmental subjectivity along divergent lines. This has primarily occurred via classic technology treadmill dynamics as a product of enthusiasts' relative position within the agricultural sector. I examine how these dynamics have given rise to the "struggling family farm" and thereby laid the groundwork for extraction enthusiasts to be hailed as pro-shale gas environmental subjects.

Extraction enthusiasts, like environmental protectionists, are formed as neoliberal farmer-subjects as a product of how they are react to external economic incentives generated by how they are situated within the agricultural economy. Over time, structural changes in the farming

sector have changed the landscape of economic incentives and deterrents, as well as the structural vulnerabilities produced with and through institutions shaping agricultural markets. Technology treadmill dynamics illustrate how the same economic stimuli can result in radically different forms of neoliberal farmer subjectivity, as agricultural producers select divergent methods of capturing value and retaining profitability. As discussed in Chapter 2, deviating technology treadmill dynamics tend to direct and lock farmers into one of two paths: 1) intensifying industrial production, with producers investing in capital-intensive technologies in order to scale up production and thereby capture more profit; or 2) employing "alternative" or "niche" production techniques to add value without intensifying production. As described in the previous section, environmental protectionists overwhelmingly adhere to the second of these groups. Meanwhile, enthusiasts tend to belong to the first group, evidenced by their tendency to employ "industrial" or "conventional" agricultural production practices: larger farm size, commodity and/or mono-crop production, chemical fertilizer and pesticide use, and sales through regional or national markets (Section 6.2.6).

Over time, their reliance on industrial agricultural production has exposed extraction enthusiasts to classic technology treadmill dynamics: in response to decreasing commodity prices, enthusiasts scale up production, often by going into debt to update farm equipment and produce more efficiently. However, several enthusiasts commented on these dynamics, noting that producing more milk, corn, or other commodities will continue to exert downward pressure on prices:

> Every drop of milk contributes to the total…and the consumption is down, our import-export market is off kilter, and [it] all does affect what all of us on the production side receive for our hundredweight of milk…Well, the price is in the tank. What caused that? Oh, I know, we can't move our product. So now we're going to pay to dump milk…We're overproducing our product and we don't have a market for it. So we add more cows and

> make more milk and then complain about the price. (conventional dairy farmer, Pennsylvania, F3 = 0.54)
>
> Corn prices are in the tank. Bean prices are lower. Dairy's struggling to make any money. Too much product…Most dairies was milking around 8,000 pounds per cow back in the '50s. So you were an elite dairy farmer if you were in the 10,000 pound club, made 10,000 pounds of milk per cow per year, and nowadays if you're making 10,000 pounds per cow per year they wonder when the auction's going to be. (laughs) Because you can't make it. You can't do it. (conventional dairy farmer, New York, F3 = 0.82)

The passages above illustrate a form of neoliberal environmentality where, in the face of decreasing commodity prices, these farmers have chosen to continue investing in capital-intensive technologies, scaling up production and increasing their output.

Such classic technology treadmill dynamics create and reproduce structural vulnerabilities within the agricultural sector: farmers are squeezed between systemic debt on the one hand, borne of the growing need to finance industrial technologies for ramping up production, and subsequently decreasing commodity prices as a result of over-production on the other hand. Together, these conditions constitute external economic incentives which prompt farmers to either continue investing in capital-intensive technologies as a temporary fix for the crisis of agricultural over-accumulation; shift to another form of agricultural production in an effort to escape the technology treadmill; or get out of farming altogether. Some farmers did describe altering their production practices to some degree; for instance, two farmers described shifting from dairy to sheep and lamb production after losing a member of the family:

> P1: My father and my mother bought this farm from his mother around 1952. And they started here. And it's been an active dairy from 52 up until the year 2000, when we decided to bail out of the dairy industry…
>
> P2: [His] dad passed away in '98, and with [him] gone, some of the honest fun went out of doing it, you always felt the missing person, and although he was older, he did an awful lot of work. And with him gone, we really needed another person…we would've had to have had an increased income to justify it. To get the added income we would've had to put on more cows to milk, which means we would've had to make a bigger barn, we would've had more land because we would have had to provide more forage for the

> more cows. And it was like this vicious circle, spiraling up, and it was just like…why are we doing this again? (conventional sheep farmers, New York, F3 = 0.49)

This passage clearly illustrates how farmers get "locked" into path dependency through industrial production (Chhetri et al., 2010). More income necessitates producing more commodity, which in turn requires investing in additional capital-intensive technologies to scale up production, resulting in the "vicious circle" summarized here. In the words of one participant (not an enthusiast), "These guys are land rich and cash poor…They've got eighty acres and a farm that looks like it's falling apart" (land grant college researcher, New York, F2 = 58).

It is here that a powerful disciplinary environmentality comes into play. From a neoliberal economic perspective, a "rational" actor could escape the technology treadmill by selling their farm to either retire or change careers. By staying on the industrial technology treadmill, extraction enthusiasts perform a disciplinary environmental subjectivity informed by a deeply held sense of place. Of the ten farmers associated with this factor, six grew up on, and now operate, multi-generational farms. The land farmed by these enthusiasts has been in their family for up to six generations, and in one case for ten generations. The length of their tenure in the area was clearly a source of pride for these enthusiasts:

> In our family, we're more inclined to be agricultural in belief, and [the farm] was settled in the mid-1800s. My father did a study on it to find us to be a century farm, and I hope and I expect our son will see the 200th year. The fact that it was settled in the mid-1840s, there's a strong possibility they'll still be producing crops in 20-plus years. And the sixth generation, as my son says, is on the ground. So our grandson or granddaughters, if they choose to, would be very much available to pursue. The farm has been able to endure a lot of challenges. (conventional dairy farmer, Pennsylvania, F9 = 0.54)

In a similar instance, a farmer had a large aerial photograph of his farm displayed on a wall, which he used to show me the boundaries of the original farm established in the 1700s. In each of these examples, extraction enthusiasts perform key internalized values of tenacity, endurance, and strength which form the foundation of their disciplinary subjectivity. Their pride in the

longevity of their farms, which have "been able to endure a lot of challenges," is intimately linked to how enthusiasts identify as farmers. As a result, enthusiasts attach great importance to the ability to maintain the family farm for future generations.

In a sense, these multi-generational family farms operate as institutions guiding the production and circulation of enthusiasts' disciplinary norms. These powerful disciplinary norms and expectations prevent many enthusiasts and other multi-generational from making the "rational" choice to let go of the farm when it is no longer financially solvent. As one farmer stated, "I cared about the farm, so I didn't want to lose the farm" (dairy farmer, Pennsylvania, F4 = 0.57). In order to avoid losing their farms, many enthusiasts continue to deepen their entrenchment along the technology treadmill in order to stay profitable. Such shared internal norms are further strengthened by enthusiasts' contention that family farming forms the bedrock of American heritage. As described in Chapter 5, enthusiasts believe farming promotes an honest, trustworthy, and hardworking citizenry – norms which further articulate with their values of self-determination, independence, and grit.

The co-existence of neoliberal and disciplinary environmentalities described above predispose extraction enthusiasts to be formed as pro-shale gas subjects – that is, as environmental subjects who are willing and eager to lease their subsurface mineral rights for shale gas extraction. The interplay between these two environmentalities is also represented and (re)produced through the discursive trope of the "struggling family farm." This narrative did not emerge in a vacuum – rather, it is the product of intersecting historically contingent social and power relations which have shaped the Twin Tiers agricultural landscape. First, farmer-landowners tend to own large parcels of land – as section Table 6.7 illustrates, the majority of farmers in the study sample have over 50 acres of land, with several owning over 500 acres. Of

the farms in this study, enthusiasts own the largest on average with a mean 351 acres per farm – a larger footprint than the regional average of 200 acres. Second, shale gas developers prefer agricultural land due to the lack of timber or building development, as well as because of the space requirements required for shale gas development (Drohan et al., 2012). Enthusiasts, who are more likely to engage in mono-crop production and use tractors or combines, are especially likely to have graded, open spaces available for well pads. Finally, farmers in this region – particularly those enthusiasts whose families have owned their land for multiple generations – are more likely to own their subsurface mineral rights than in regions with histories of extractive industries like Texas, or regions that were primarily colonized after 1908, when the Homesteading Act began separating surface from subsurface rights (Fitzgerald, 2014). Together, these historically and contextually contingent power relations have uniquely positioned farmer-landowners – and particularly extraction enthusiasts – as key gatekeepers in the Marcellus Shale Basin, whose decision whether or not to lease their mineral rights carries significant consequences for the extraction and commodification of shale gas resources in the region.

From this perspective, it makes sense to view the classic technology treadmill as a neoliberal technology of governance which serves the needs of the oil and gas industry. Embedded within an economic sector that is deeply shaped by structural financial vulnerabilities, enthusiasts who are "land rich and cash poor" are induced to lease their subsurface mineral rights to resolve their debt and thereby "save the family farm". In this way, enthusiasts enact two related yet distinct forms of neoliberal environmental subjectivity, which are further informed by a disciplinary imperative to "save the family farm." First, they react to the crisis of agricultural over-production by scaling up production and investing in ever more capital-intensive solutions.

Second, in response to the deepening over-production crisis reproduced through their earlier decisions, these farmers lease their subsurface mineral rights, if able to do so.

Together, these actions prompted by a neoliberal environmentality promote shale gas development as a spatial fix which to resolve the crisis created through technology treadmill dynamics (Jessop, 2004). Farmers who lease their subsurface mineral rights engage in a strategy of spatial reorganization by shifting extraction activity to their farm's subsurface geologic formations, thereby temporarily correcting the crisis precipitated through agricultural over-production. However, not all farmers are in a position to spatially restructure their farm's production strategy in this way, as illustrated by the intersecting domains of location and leasing status outlined in Chapter 6. Because the majority of participants who align as enthusiasts are located in New York, they are unable to lease their subsurface mineral rights and receive drilling royalties, despite having been successfully hailed as pro-shale gas subjects. As a result, many enthusiasts exhibit anxiety about what this could mean the future of their farm. For instance, one New York-based enthusiast reflected that being able to lease his land would improve his quality of life: "I would hope they would have some of my land involved so I could get a royalty. I've worked all my life. Right now, I got two jobs. This one [at a home improvement store] and the farm. I can't keep up with both of 'em…The last two nights I only got five hours of sleep…Hate to think about all the stuff I gotta get done" (conventional hay farmer, New York, F3 = 0.69). Similarly, a Pennsylvania-based enthusiast bemoaned how low natural gas prices had sharply decreased shale gas activity in his county, citing as an example a neighboring farm that leased late and was unable to materially benefit from their mineral rights as a result: "Here's kind of a sad state of affairs. This farm is in a bad way financially. Their barn burnt…So they built this back, but they bought cows when they were high. Milk price fell. A lot of other circumstances

has compromised them. And there's a well pad there, that if that were to produce, it would save this farm" (conventional dairy farmer, Pennsylvania, F3 = 0.54).

From this perspective, shale gas income can be used to update farm equipment, pay off debt, and purchase more land. Farmers who do so continue to perform the intersecting forms of neoliberal and disciplinary agricultural subjectivities outlined above by deepening their articulation with technology treadmill dynamics and continuing to scale up production and make their farms more efficient. For example, one of my pilot participants used his royalties to "modernize" his dairy farm, upgrading to a fully automated robotic dairying system – the same farmer, in fact, whose experiences led to my interest in the relationship between farming and shale gas in the first place. While driving to various farms across the Pennsylvania Northern Tier, the juxtaposition of older farming equipment or outbuildings with newer machinery, silos, and barns became a familiar sight. Numerous participants related anecdotes of neighbors and acquaintances who invested this new source of income back into their farms. In this way, enacting their pro-shale gas subjectivity further reinforces enthusiasts' agricultural subjectivity, and continues the cycle of systemic vulnerability that locks farmers into certain production practices.

However, due to the continued downward pressure on commodity prices, extracting energy from farmland could now be considered one of the suite of industrial production techniques which such agricultural producers must rely upon in order to stay on their land and continue farming (Malin, 2013; Hitaj and Suttles, 2016; Malin and DeMaster, 2016). In fact, extraction enthusiasts tend to view energy development as comparable to agricultural production: both are forms of extractive industry, with energy serving as an additional product to be harvested from their farm. This perspective is made apparent in the following passage:

> I feel as a farmer, I'm being discriminated because I live in New York. That they're putting a regulation that no other farmer has to live with in this country. Every other, we're the only state that has this thing. Any other farmer could sell his rights, his mineral rights, if he had that kind of formation. And really sad about it is that I'm paying the highest property tax on farm land than almost any other farmer in the country…and I can't sell or lease an asset that could help me pay for it. (organic dairy farmer, New York, F3 = 0.54)

As this extraction enthusiast puts it, shale gas is "an asset" on his farm that, as a private property owner, he should be able to capitalize upon. However, this passage also gestures to the role of top-down, sovereign power in shaping enthusiasts as environmental subjects. Similar to environmental protectionists, the threat and later enactment of the New York state ban on hydraulic fracturing serves as an exercise of sovereign environmentality and power. New York-based enthusiasts have emerged in reaction to sovereign anti-drilling environmentality to perform their own subjectivity of resistance. Enthusiasts view this act of power through the lens of their political orientation: they feel "discriminated against" as farmers, as the excerpt above states, but also as politically conservative farmers whose mineral rights were "stolen" by upstate "liberal Democrats" (conventional dairy farmer, New York, F3 = 0.82).

The language of restoring one's "stolen" private property rights opens a window into the process of territorializing and materializing the social relations of property. The idea that property rights (not even the property itself) can be "stolen" is predicated upon the act of inscribing the social relations of property on the physical landscape – an act that is infused with symbolic and ideological meaning. Through this ideological work, landowners are produced as sovereign rulers within their individual fiefdoms, as one participant's comment illustrated: "I am the keeper of my land. There's no better person that's going to take care of my land than me. You yourself can't come here and take care of my land…I know what's best for my best interests, for my own personal use, livelihood, family, et cetera" (conventional goat farmer, New York, F3 = 0.50). In this way, private property becomes a powerful symbol of independence,

autonomy, and self-determination (Blomley, 2016) – a symbol widely used by extraction enthusiasts, particularly in areas such as New York where they have been unable to legally lease with the natural gas industry.

Discursively, extraction enthusiasts most closely align with the narrative that "shale gas saves struggling family farms". Through a combination of neoliberal, disciplinary, and sovereign environmentalities, enthusiasts have emerged as pro-shale gas environmental subjects. However, because the majority of study participants who align as enthusiasts are located in New York, they have not been able to accrue royalty income by leasing their mineral rights. In this way, the New York state ban, as an ongoing source of top-down sovereign power, has played a significant role in the continued reproduction of enthusiasts' pro-drilling subjectivity. Yet at the same time, the following factor – skeptical individualists – indicate a possible future shale gas politics, if enthusiasts were to eventually gain the ability to lease their subsurface mineral rights.

7.5 Factor 4: Skeptical individualists

Unlike any of the other factors, skeptical individualists distinguish themselves by *not* holding a strong discursive position towards shale gas development. Individualists do not identify as part of the shale gas debate, and are the only factor not to see themselves as highly educated about shale gas extraction and its effects. Yet unlike the other factors, individualists as a group have the highest proportion of participants who have directly experienced drilling on or underneath their land. Thus, while extraction enthusiasts exhibit the most pro-shale gas subjectivity of all the factors from a discursive standpoint, skeptical individualists are the most likely to have actually enacted a shale gas environmental subject position by leasing and drilling their subsurface mineral rights. This contradiction is what makes skeptical individualists unique among the four worldviews examined here.

I argue that skeptical individualists present a kind of counterfactual subjectivity to extraction enthusiasts. As agricultural environmental subjects, individualists are subject to many of the same disciplinary pressures and neoliberal incentives as enthusiasts. However, their exposure to sovereign exercises of power differs from enthusiasts, in that individualists are composed mostly of farmer-subjects who have received royalty income from their subsurface mineral rights. I examine how skeptical individualists emerge as environmental subjects through the co-existence of disciplinary and neoliberal environmentalities: disciplinary discourses of "rugged individualism" articulate with neoliberal tactics of decentralized environmental governance and technology treadmill dynamics to produce an individualist environmental subjectivity.

Discursively, skeptical individualists are most concerned with preserving and protecting individual private property rights, and tend to view the issue of shale gas development through that frame:

> If the state can ban [hydraulic fracturing], what else can they ban? Because really it's the use of land and what the government regulates and doesn't regulate is the bigger worry…A landowner. The opportunity to sell a product that is his was denied that opportunity. That's the problem. Talking about landowner rights. So what else is next? What else can they ban across the board and not compensate people for it?...They kept focusing on natural gas. That's not the problem. It's the banning of something that's currently legal in all states that was taken away from you. That's the problem. Because if you can ban this, what else can you ban? (sustainable/non-organic livestock farmer, New York, F4 = 0.54)

This position is similar to that taken by New York-based extraction enthusiasts, who – as the previous section explained – believe that their mineral rights have been "stolen" by the government. However, enthusiasts' subjectivity has coalesced around shale gas development as a central driving force, due to its being withheld. In contrast, shale gas does not constitute a fundamental aspect of individualists' outlook: while they believe farmer-landowners should be

able to "sell a product that is his," individualists themselves are somewhat agnostic about shale gas development itself, which they argue is "not the problem." Instead, it is the question of "landowner rights" around which skeptical individualists emerge as environmental subjects. This is due in part to how individualist subjectivities have already been shaped through mutually reinforcing disciplinary and neoliberal tactics, but also due to the uneven temporal dynamics of their own experiences with shale gas extraction.

The individualist valorization of private property rights – as illustrated in the passage above – is a product of interconnected neoliberal and disciplinary exercises of power. From a disciplinary environmentality standpoint, skeptical individualists enact and reproduce a discourse of "rugged individualism." Individualists value independence and self-reliance as foundational to American heritage, and view the family farm as a key symbol of these virtues:

> Your farms and your farmers are kind of the core values of what has made our country great, and I don't see a lot of positive in our core values as a nation as an average here right now. Watching…these pro athletes not being willing to stand for the pledge of allegiance…These are core values that shouldn't be challenged. You know, we need to respect God and country, and fundamentally your family farmers are those values…[Not a lot of people] get up and actually go out and work and earn what you get. [That] attitude seems to be less and less and far too many people just [say]…who is going to give me [a handout] today. (conventional produce farmer, Pennsylvania, F4 = 0.52)

As this passage demonstrates, skeptical individualists see farming as exemplifying core American values of hard work, autonomy, and self-determination. From a disciplinary standpoint, this passage also does a lot of work to (re)produce a disciplinary discourse of rugged individualism as a "core value [that] has made our country great." Rather than asking for "handouts," farmers "get up and actually go out and work and earn what [they] get" – an approach which individualists see as uniquely and inherently American, as well as directly tied to the lifestyle of farming.

For individualists, the ability to enact these values is intrinsically tied to private property ownership. As another individualist explained:

> [If you could] access the land for a cheap amount of money and produce this product where you're compensated, you might not make a white collar salary but you'll make a comfortable living, and you can raise kids that will never be hungry and you can instill a couple values…that would be a noble life. (sustainable/non-organic livestock and maple syrup farmer, New York, F4 = 0.76)

From this perspective, private property is an investment that provides the foundation for a "comfortable living," while the act of extracting a living from one's land instils those tenets cherished by individualists such as self-reliance, freedom, and industry. Together, these passages exemplify how rugged individualism discourse successfully disciplines skeptical individualists to esteem and defend these internalized principles.

Concurrently, rugged individualism doctrine co-produces a neoliberal environmentality by shaping skeptical individualists as subjects who support the continued decentralization of environmental governance. Individualists argue that the locus of decision-making should lie with landowners, rather than with the state, oil and gas industry, or other institutions that apply top-down governance tactics (an inherently contradictory position, as extensive state intervention is required to produce and maintain private property as an institution in the first place). However – as noted previously – the devolution of environmental decision-making from the federal and/or state government to private property owners serves the interests of the natural gas industry, by positioning farmer-landowners as key gatekeepers in the Marcellus region. While skeptical individualists valorize the independence and autonomy that they see as tied to their private property ownership, they – like other farmers in this study – are simultaneously formed with and through neoliberal exercises of power through technology treadmill dynamics, which shape and constrain their decisions in fundamental ways.

Like extraction enthusiasts, skeptical individualists largely employed conventional and industrial agricultural methods prior to the Marcellus boom in the mid- to late 2000s. For example, four of the seven individualists were employed through conventional dairying at that time – a sector where treadmill dynamics have drastically escalated since the 1990s, with dairy farmers subjected to rapidly increasing operating costs on the one hand and strong downward pressure on commodity prices on the other. However, by virtue of their spatial and temporal locations, these individualists were able to lease their subsurface mineral rights – unlike extraction enthusiasts.

Thereafter, these individualists performed a neoliberal environmental subjectivity by using their per-acreage signing bonus and royalty income to shift their production practices towards "niche" or "alternative" farming in order to farm more profitably, thereby escaping the classic technology treadmill. For instance, one Pennsylvania-based dairy farmer used his royalties to pay off his Farmers Home Administration loan, allowing him to shift to grass-based dairying and transfer the farm business to his daughter. Two other former dairy farmers in Pennsylvania shifted to vegetable and beef production. A fourth individualist, located in New York but able to lease his subsurface rights for oil production, directly connected his royalty income to his ability to shift away from conventional dairying towards livestock management using intensive rotational grazing:

> We stopped milking in 2003…and so there was that five year period where I generated enough money to pay for the taxes and stuff, but it really wasn't enough for a living and it was sporadic. But we had at that time oil and gas checks coming in, and so it bought me five, seven years to create a new [farming] philosophy, one that I believed in…It bought me that window to find a productive model. (sustainable/non-organic livestock and maple syrup farmer, New York, F4 = 0.76)

As this passage illustrates, individualists see a direct link between the ability to lease and financially benefit from their subsurface rights, and the capacity to make a living from farming.

Thus, they epitomize the discursive trope of the "struggling family farm saved by shale gas" that is reproduced by extraction enthusiasts, as the last section outlines. If this is so, and on-farm energy development made it possible for these farmers to emerge from the industrial agriculture technology treadmill, why are skeptical individualists less passionate about shale gas development than the extraction enthusiasts?

From the perspective of the oil and gas industry, it is irrelevant whether these farmers "buy in" to shale gas development. The majority of individualists have already performed a shale gas and/or oil environmental subjectivity: they have signed, and are locked into, drilling leases which open their subsurface mineral rights up for extraction and commodification. In a sense, skeptical individualists therefore best exhibit the temporal dynamics shaping shale gas environmentality. While they may have originally aligned as pro-shale gas subjects early in the Marcellus boom, they have normalized its impacts – both positive and negative – over the intervening years. For instance, a common theme among individualists was the observation that the benefits of shale gas development were not as great as they had hoped. For instance, one farmer who had transitioned from dairy to produce commented that "vegetables has been probably more financially challenging than what dairy was," explaining:

> We got our first royalty checks in September, I think, of 2011. They were pretty good at the time. And we used the gas royalties, I guess, maybe rather foolishly, to build our greenhouses and vegetable business, and thought, got that done, we would have used the money to save or whatever. But about the time we got things all done, the royalties went from several thousand dollars a month to a couple hundred dollars a month. And so (pause) (laughs) we put all the main amount of money that we got from royalties, so far anyway, we put into that, and then we haven't had much since then. (conventional vegetable farmer, Pennsylvania, F4 = 0.59)

Similarly, another farmer showed me a royalty check he received the previous month for $6.14 – due, he said, to the bottoming out of gas prices. Another individualist explained that Chesapeake

Energy, the company with which he signed his lease, had been taking out post-production costs from his royalties for several years.[31]

Together, these experiences illustrate why skeptical individualists do not consider shape gas development to be an especially timely or important topic. Those individualists who have leased their subsurface mineral rights no longer expect to receive significant monetary benefits from it, and institutions such as the oil and gas industry see no need to continue expending resources to convince landowners that they should lease. As a result, other aspects of individualists' pre-existing environmental subjectivities become more prominent, such as the disciplinary ethos of rugged individualism and the neoliberal context of the agricultural sector which continue to shape their farming practice. However, the issue of shale gas development, and fossil fuel extraction more broadly, no longer functions to the same degree as a catalyst shaping environmentalities which act on these participants. For those individualists who have leased their subsurface mineral rights, this temporal dynamic explains why their worldview aligns with other landowners who are not in a position to lease, but for whom protecting landowners' rights are their overriding concern.

7.6 Conclusion

Environmental subjectivities are unstable, malleable, and inconsistent. The Marcellus shale gas boom has perturbed the networks of institutions, knowledges, politics, and discourses which together co-produce environmental subjects. However, it would be an oversimplification to argue that shale gas development has radically or permanently disturbed these relationships. For the majority of participants, the issue of shale gas development maps onto always already formed and performed environmental subjectivities. Yet as this chapter illustrates, the pre-

[31] In 2018, Chesapeake settled a class action lawsuit by agreeing to pay $7.75 million to affected leaseholders in the Pennsylvania Marcellus region (Holland, 2018).

existing environmentalities which inform individual environmental subject positions may condition, but do not determine, how participants relate to and view shale gas development.

While the introduction of shale gas extraction may not prompt a complete reorganization of the multi-subjectivities through which participants' subject positions are produced, it does open new spaces of synergy and tension between overlapping layers of environmental governance, knowledge, and power. For instance, shale gas has served as a catalyst around which both environmental protectionists and extraction enthusiasts have coalesced as shale gas environmental subjects. These particular forms of shale gas subjectivity, whether of resistance or support, became for both factors a predominant topic stimulating organization and action. In each case, shale gas respectively contravened or accorded with participants' previously-held convictions, discourses, and economic experiences.

Analyzing each worldview as embodying and enacting diverse multi-subjectivities also helps to deconstruct the dichotomous frames which dominate popular media portrayals of shale gas development. Dualisms such as pro/anti-drilling or economy/environment frames erase moments of fusion or partial interpellation. However, highlighting the competing and contradictory exercises of power which produce participants as environmental subjects opens conceptual space to examine hybridity and incompleteness within the politics of subjectivity (re)production.

All research methodologies behave as tools of simplification, and Q methodology is no different. The premise of Q methodology rests on the contention that each factor represents a collectively held worldview, and that is true to an extent. However, I wish to reiterate that each factor in fact represents an *idealized* narrative. No single participant wholly aligns with the encapsulated worldview – for example, participant #17 loads onto Factor 1 at 56 percent, while

participant #19 loads onto the same factor at 72 percent (Appendix B.1). Both participants are affiliated with the balanced rationalist worldview, but while one sorted the Q set statement in a pattern with a higher degree of similarity to the "ideal" version, neither could be described as fully aligning with this representation.

In contrast to the sanitized organizational schema imposed by Q methodology, which presents the extracted worldviews as shared equally across all associated participants, I would argue instead that *all* participants enact partial, incomplete, and/or hybrid environmental subject positions. The idea of being comprehensively formed as any kind of environmental subject, or relative to any exercise of power, is itself an idealization. All subjects are constantly negotiating the push and pull of various, competing, and contradictory sources of power – conceptualized here as overlapping and intersecting neoliberal, disciplinary, truth, and sovereign environmentalities. Individual participants straddle institutional roles, differentially exposing them to diverse representations and knowledges. Thus, this analysis is invariably partial and incomplete, as are any attempts to parse the myriad forces from which environmental subjectivities emerge.

CHAPTER 8

CONCLUSION:

AGRICULTURE, SHALE GAS, AND THE POLITICAL WORK OF BINARIES

1.1 Findings, contributions, and limitations

As stated in Chapter 1, this dissertation sought to address the following question: *How are farmers being hailed as environmental subjects at the confluence of agriculture and shale gas*? By situating this research question at the intersection of the environmentality, science and technology studies, and agro-food studies literatures, I grappled conceptually with the inconsistency, instability, and unevenness which characterizes networks of environmental institutions, knowledges, politics, and discourses, and which co-produce – and are co-produced alongside – environmental subjectivities. In particular, my research has investigated the degree to which the introduction of shale gas development has perturbed and (re)shaped farmers' environmental subjectivities, using Agrawal's (2005) environmentality framework and Fletcher's (2010) Foucauldian typology of conservation environmentalities. In Chapter 6, I examined the circulation of environmental *knowledges* as key discursive representations across, within, and through agricultural landscapes, as well as the role of significant *institutions* which seek to shape and govern flows of environmental *discourse* and its production, application, and erasure. In Chapter 7, I explored the emergence of an environmental *politics* of knowledge through the interplay of diverse, competing, and contradictory exercises of power. I further analyzed how these variables influence and inform the dynamic production of environmental *subjectivities*, which are realized at the confluence of overlapping environmentalities that seek to shape farmer-

landowners' behavior in particular ways. Placing these chapters together illustrates the utility of an environmentality approach, and how it facilitates a supple and nuanced theorization of the compounding layers of power/knowledge through which environmental behavior, perceptions, and meanings are shaped.

In this dissertation, I pilot two key interventions. The first is theoretical, the second methodological. First, I argue that Agrawal's (2005) environmentality framework, and Fletcher's (2010) subsequent typology, require a more thorough theorization of discourse. Specifically, discursive regimes act as the foundation upon which different environmentalities and governance rationalities are built, with discourse as the medium facilitating translation across and between the actors and nodes which make up environmentality networks. I focus particularly on knowledge as a significant form of discursive representation and circulation. As the shale gas debate plays out across the Marcellus Shale Basin, a major portion of environmentality politics takes place within the landscape of competing knowledge claims. This landscape is deeply shaped by boundary-work by various actors seeking to assert their own and restrict opposing claims to legitimacy, authority, and expertise. A closer attention to discourse is necessary as the means through which knowledge claims are represented, and how these representations are produced, circulated, applied, and obscured.

Second, I develop and deploy critical Q methodology as a unique and innovative methodological contribution and a means of empirically rendering these complex interactions. Critical Q proves particularly useful for exposing and highlighting the pliability, unevenness, and erraticism of the networks which shape environmentalities. Yet while I present this dissertation as a static snapshot in time, in truth the worldviews co-produced through the efforts of the study participants and myself are deeply unstable. Furthermore, each of the worldviews produced and

analyzed here are contingent upon specific historical, spatial, and temporal particularities. Together, the conceptual and methodological approaches used in this dissertation demonstrate that environmental subjectivity formation is inherently an imperfect, ongoing, and partial process. As the recipients of coinciding and competing exercises of power, participants are always already interpellated as subjects at the confluence of multiple arts of governance which seek to constrain and promote certain forms of (un)desirable conduct. Disturbances such as the Marcellus boom can unsettle and interrupt these networks, but such changes are by no means permanent or predictable.

As this dissertation illustrates, critical Q can serve as a distinctive and valuable methodological approach that helps researchers re-examine epistemological assumptions. Counterpoising Q methodology and critical discourse analysis has allowed me to deconstruct reductive pro/anti-drilling and economy/environment binaries, explore how tropes such as the "struggling family farm" are deployed and contested by various stakeholders within the Marcellus shale gas debate, and examine the uneven social and power relations through which these discursive artifacts continue to be (re)produced. Furthermore, I see great utility in using critical Q to reflexively open up and examine the researchers' subjective choices as a central aspect of designing and conducting Q studies. In this way, I hope to continue deconstructing narratives of Q methodology as an "objective" measure of subjectivity that "reduces" or "removes" researcher bias.

While critical Q methodology does present multiple methodological and conceptual advantages, it also has some noteworthy limitations. Perhaps most significantly, Q presents factors as equally weighted in terms of influence. Without doing the necessary work of identifying how a study's identified worldviews map onto extant social and power relations, a Q

study may give a false or limited representation of the power dynamics which shape how each perspective relates to the others. Second, critical Q is a means of simplification, where heterogeneous and idiosyncratic individual perspectives are reduced into a smaller and more manageable number of shared perspectives. As I have noted multiple times throughout the dissertation, these shared worldviews are idealized and sanitized. However, the conventions of research design, interpretation, and communication in the Q community involve presenting each worldview as a comprehensive and shared narrative (see Chapter 5), despite the fact that individual participants almost never perfectly align with a perspective. I have attempted to address this disparity to some degree by including each participant's factor loading when including participant quotations. However, more work needs to be done in the future to theorize and work through this contradiction.

I wish to note several additional limitations to the dissertation research presented here. First, although I made an effort to include farmers across a range of production practices and farm sizes, most large-scale farmers never responded to my interview requests. Relatedly, I also had a difficult time finding conventional/industrial agricultural producers to take part in the study. There are two potential reasons for this: First, many of these farmers might not have had time, given the scope of their operations and business. Second, some of these farmers, particularly those that were active in the pro-drilling movement in New York state, may have considered me to be politically biased against them. Although I had an "insider" introduction to many farmers who were active in New York's landowner coalitions and pro-drilling advocacy, most of them never responded to my repeated interview requests, and only one completed a Q

sort.[32] As a result, the pool of participants does not include all of the perspectives that I would have liked to include at the outset, and is somewhat skewed towards small- and mid-scale farmers in the region.

A second limitation is that this dissertation focuses primarily on the institutions, participants, and knowledges which seek to interpellate farmers as pro-shale gas subjects. As a result, the role of anti-fracking activists – represented through the environmental protectionist factor – is less fully developed here. This choice was partly due to the dissertation's limited space and scope. However, I am also attentive to the possibility that my research could be "weaponized" by pro-industry groups and institutions. I worry that an in-depth deconstruction and critique of the environmental protectionist worldview could potentially be deployed by groups such as the industry-run *Energy In Depth* website/blog in an effort to de-legitimize regional environmental advocacy.[33] However, this topic does present a potential direction for further research in the coming years.

Third, I chose not to include data such as interview excerpts from those nine participants who either did not significantly load onto one of the four study factors, or who were confounded between them. While this choice was informed by limits within the dissertation's scope, I am keenly aware that not including these participants' voices and perspectives constitutes a form of erasure that also presents the Q study findings as clean, comprehensive, and complete. In fact, the presence of perspectives outside of the four study factors is a valuable source of data that undergirds my central thesis: namely, that environmental subjectivities are messy, incomplete,

[32] One additional participant did grant me an interview, but refused both to sign a consent form and to complete a Q sort. As a result, I did not feel it was ethical to include his comments – although I will note that he had a "Do Not Tread On Me" flag on his front porch.

[33] While it might be putting the cart before the horse to worry about this now, *Energy In Depth* in particular makes a habit of identifying researchers and publications that it sees as anti-industry, and publishing what can be very ugly critiques. One of my participants had his house address published on *Energy In Depth* and was subjected to hate mail, as well as having his mail stolen.

and precarious. Thus, while I did not include that data in the dissertation, I will certainly be addressing this gap in the near future.

Lastly, I wish to reflect on how the choices I made while designing the Q study have shaped the results presented here. This is not so much a limitation of the dissertation per se, but rather a recognition that my subjective choices have played a central role in determining what results emerged and the form which they have taken. For instance, in constructing the concourse and Q set, I made a choice to include a diverse selection of statements, many of which did not relate directly to the intersection of shale gas development and agriculture. This was a deliberate choice to include themes and topics that are ancillary to the shale gas debate as it plays out on rural, agricultural landscapes. However, a different approach could have been to craft a smaller Q set that was tighter in scope, and to elicit participants' views on some of these related themes (e.g. attitudes towards organic and sustainable farming) during the post-sort interview. I would not say that my choice was necessarily "right" or "wrong," but rather that it created and bounded a specific, situated discursive terrain upon which the Q study played out, and inevitably shapes my findings and analysis as a result.

1.2 "Land rich, cash poor": Revisiting the struggling family farm

It was a crisp November day, four years to the month after touring the robotic dairy and seeing the fruits of one farm's shale gas royalty income. I was sitting in the home of another dairy farmer, wrapping up our interview. Like his Pennsylvania-based counterpart from Chapter 1, he was firmly in favor of shale gas development. But unlike that farmer, he was unable to lease his subsurface mineral rights, due to his farm's location five miles north of the Pennsylvania-New York state border. This circumstance had made him a staunch pro-drilling advocate who was highly involved in his landowner coalition to protest the hydraulic fracturing

moratorium.[34] As he inveighed against New York Governor Andrew Cuomo's decision to ban hydraulic fracturing, I was arrested by the following statement:

> This state is noted as being very progressive for everybody's rights. We're the first ones to give people rights for every right you can imagine. But, for me, who feeds these people three times a day…I don't have any rights in this state, compared to a farmer in another state. And I feel like I'm being discriminated against. You know, one time I made a comment, in a meeting we were having, I said I feel like my farm is one of Governor Cuomo's plantations. (organic dairy farmer, New York, F3 = 0.54)

This farmer's comment – that he feels subject to discrimination, and likening his farm to a plantation and himself to a slave – is one of the few instances in my interviews that latent racialized codes which deeply inform the shale gas debate were rendered unequivocally and overtly visible.

Almost no participants explicitly mentioned race during the interviews, but racial categories, symbols, and language did emerge throughout my time in the field. For example, while all of the study participants coded (to my perception, at least) as white, two farmers wrote "American" as their race/ethnicity. One farmer told me that "these pro athletes not being willing to stand for the pledge of allegiance" were challenging "core values of what make our country great" (conventional vegetable farmer, Pennsylvania, F4 = 0.52). As I drove to one farm for an interview, I passed a road sign noting I had entered the town limits, which featured an illustration of a Native American man wearing an eagle feather warbonnet.[35] Names like Otisco, Keuka, Cayuga, Seneca, Osceola, and Tuscarora dotted the landscape.

These examples highlight separate but related acts of profoundly racialized place-making, against which the politics of the Marcellus shale gas boom are playing out. Road signs bearing

[34] The moratorium was enacted in 2008, until Governor Cuomo announced the state-wide ban in December 2014.
[35] The illustration depicted a warbonnet of the style worn by Plains Indian tribes such as the Sioux, Crow, or Cheyenne tribes. However, modern day New York is home to the Iroquois Confederacy, which does not wear this headgear.

Native American names and insignia gesture to the violent displacement of the indigenous peoples from land now owned and operated by white settler farmers. Inscribing one's race as "American" simultaneously manifests and erases whiteness through the twin processes of colorblindness and universalism (Guthman, 2011). The side-by-side operationalization/erasure of white supremacist logics is paralleled by the portrayal of (mostly black) professional athletes as un-American for kneeling during the U.S. national anthem. Together, these actions constitute racially-informed practices through which "America" as a nation is produced as unambiguously white.

It is in this context that I wish to revisit the "struggling family farm" narrative, which has been adroitly used by the oil and gas industry to interpellate farmers – particularly those farmers caught on the treadmill of conventional agricultural production – as shale gas subjects. The struggling family farm enacts a form of what legal scholar Ian Haney López (2015) calls "dog whistle politics," or those "coded racial appeals that carefully manipulate hostility towards nonwhites" (p. x). Although appearing to be unrelated to race, these appeals and codes "powerfully communicate messages about threatening nonwhites" while preserving the ability for speakers to claim they weren't talking about race at all (p. x). In this way, López argues, politicians deploy strategic obfuscation – such as through logics of universalism and colorblindness, as in the examples above – to win elections and consolidate power.

I argue that the struggling family farm trope functions as an act of politicized and racialized dog whistling. First and foremost, the institution of the family farm is coded as culturally white. Its production as an institution is firmly grounded in the mythology of the multi-generational family farm, and predicated upon the violent dispossession of indigenous landholders for the benefit of European settler-colonialists. As demonstrated in Chapter 7, this

mythology constitutes a foundational aspect of the disciplinary imperative driving many farmers to preserve their farms. As one farmer summarized towards the end of our interview, "I cared about the farm, so I didn't want to lose the farm" (conventional/grass-based dairy farmer, Pennsylvania, F4 = 0.57). Further, the family farm as an institution is founded upon the private property regime (Chapter 6) for its original existence and continued reproduction. Settler-colonialism, and the original production of family farms, was and remains a state-driven and sanctioned process which privileges white citizens and taps into deeply ideological logics that value the independence afforded through private property ownership.

Family farms are situated at intersecting axes of privilege and subjugation. On the one hand, through the social and power relations reified through private property, U.S. landowners create and maintain generational wealth in a way that people of color have not been able to do to the same degree. Private property relations in the U.S. thus formalize and harden uneven landscapes of power, privilege, and influence, even for those farmers that do not operate multi-generational farms. However, farmers are also subjected to the turbulence, volatility, and instability of agricultural commodity markets. One livestock farmer described feeling like a "victim," explaining that "I just raised the beef, we take them to the auction twice a year, whatever they got, you got, and never mind that fertilizer went up 180 percent, doesn't matter, you still got the same price per pound" (sustainable/non-organic livestock farmer, New York, F4 = 0.76). As a result, many farmers who are caught on the treadmill of production and locked into particular forms of agricultural path dependence feel that they lack agency and control. In the words of one participant, "These guys are land rich and cash poor" (land grant college researcher, New York, F2 = 0.58).

The "struggling family farm" narrative is a product of these articulations of opportunity and oppression. However, as the excerpt at the start of this section illustrates, many farmers do not recognize their privilege as landowners, or how these advantages are produced through deeply uneven and racialized landscapes of power that have benefited them and their families over time. In this way, the struggling family farm has emerged as a racial code communicating deep-seated anxiety over changing demographics, and what those changes mean for white political power in America. Although it is beyond the scope of this dissertation, deconstructing the struggling family farm narrative as a discursive stand-in for white anxiety prompts numerous questions about how to consider the racial dimensions of the shale gas boom within the current political landscape.

For me, the shale gas debate – particularly in New York – stimulates certain comparisons to the 2016 political election. Themes such as rural-urban relations, deep partisan divides, and energy independence all emerge from, and are co-produced alongside, deep-seated and racially informed fears that characterize both debates. Additionally, both the shale gas debate and President Trump's rise to power are deeply marked by bitter contestations over knowledge and "truth". For instance, one farmer told me that he believed the *New York Times*' coverage over hydraulic fracturing was a practice run for their later "fake news" campaign against Trump. While I disagree with the substance of his statement, it does provoke me to consider the Marcellus boom, and the divisive dispute that followed, almost as a rehearsal for the election cycle which followed a few years later.

Comparing the Marcellus shale gas boom and the 2016 presidential election throws into relief the strategic use and political work of binaries. In this dissertation, I explore how a number of articulating binaries, such as pro/anti-drilling and economic benefit/environmental

degradation, frame the debate over shale gas development. A further implementation of bipolar politics emerges through the use of boundary-work (Gieryn, 1983), which seeks to demarcate science from non-science, fact from fiction, and right from wrong. The shale gas debate – and to some extent, the 2016 election cycle – operationalize these kinds of us-versus-them bipolar framing through knowledge politics (i.e. the "fake news" strategy of delegitimizing President Trump's detractors).

During my fieldwork, I found myself on the receiving end of some of these "fake news" discourses. For the most part, the farmers I spoke to were friendly and welcoming. However, I didn't hear back from many farmers, particularly those who had been highly active in pro-drilling activism in New York. Generally, I just never got a response, or received a polite refusal. But in one case, I received a series of strongly worded messages from one potential participant who had been recommended to me as a good contact due to his extensive educational and advocacy work with New York landowner coalitions. Below, I reproduce some key passages from each email:

> I disagree with a methodology which forms opinions by leading questions, drafted by the study's author…All answers in this life require context. Your methodology fails to allow for context. I foresee that readers may misunderstand the farmers' answers.
> …
> The hopes and opportunities of the Southern Tier suffered horribly from the shill opposition of urban activists who ignored the fact that urban power sources and heating sources relied heavily on natural gas, and that the NYC and its surroundings now import their gas from Pennsylvania instead of NYS [New York State]. Farmers here know and feel that irony every time they pay their land taxes - and every time that a neighbor abandons farming.
> …
> Anti-gas urbanites went to Albany and convinced Cuomo to subvert the entire permit process. That is the better story - the global warming hysteria fractured the state of New York and diverted the public's attention away from very serious local non-global warming highly sensitive environmental issues. The fracking issue has no life in NYS and one can already imagine the slant your survey will take, based on its reliance on leading questions. (personal communication, November 7, 2017)

> Nearly all the opposition came from urban areas with nothing at risk if they shut down the development potential of the Southern Tier…It felt and still feels that the urban areas wish that the upstate would simply accept that we should be the subclass of service communities for NYC metropolitan interests.
> …
> Frankly, most of us no longer trust "researchers" because the way that "researchers" willingly acted politically to advance the urban anti-gas agenda, all in the name of stopping global warming. Global warming has become the trump card for every environmentalist who doesn't like a project, big or small. Rational thinking in the environmental movement has been replaced by political thinking. (personal communication, November 8, 2017)

There are three acts of boundary-work (re)produced in these emails that I wish to highlight in order to unpack the ideological and political work they perform, and the binaries that they (re)produce. Notably, these sites parallel themes and tactics used by the Trump campaign and administration.

First, the emails construct and enact boundary-work which positions my research as biased, non-legitimate, and deceptive. The author describes my project and methodology as using "leading questions" and "fail[ing] to allow for context," resulting in a politicized "slant" to my study. He also puts "researchers" in scare quotes to signal skepticism about my credibility, and the credibility of other academics. Second, the emails aim to delegitimize the work of environmental activists, with the author arguing that "rational thinking" among environmentalists "has been replaced by political thinking." He – like the Trump administration – downplays the importance of climate change, instead describing it as "hysteria" that serves as an environmentalist "trump card." In this way, the author reifies an economy/environment binary by contrasting an environmentalist agenda against farmers' financial success. Lastly, the emails perform an act of boundary-work along an urban/rural dichotomy, in which the "shill opposition of urban activists" and "anti-gas urbanites" are pitted against the struggling farms in New York's southern tier. The author also echoes the representation of farmers "working Cuomo's

plantation" from the beginning of this chapter by describing rural southern tier communities as the "subclass of service communities to NYC metropolitan interests."

The idea that there is a growing "urban-rural divide" in the U.S. has gained traction in the popular media following the 2016 election (Badger, Bui, and Pearce, 2016; Gamio, 2016; Kurtzleben, 2016). The rural/urban dichotomy further articulates with racialized power dynamics, with terms such as "urban" or "inner-city" frequently deployed as racial codes for black and poor. Deconstructing the "struggling family farm" narrative offers a further point of entry for engaging a rural/urban framing, both of the shale gas debate and of our current political moment. While it is beyond the scope of this dissertation to do so in greater detail than what this section accomplishes, it is a direction rich with opportunity for further scholarly work – and one that will likely continue to increase in relevance in the years to come.

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APPENDICES

Appendix A:
Q Study Materials

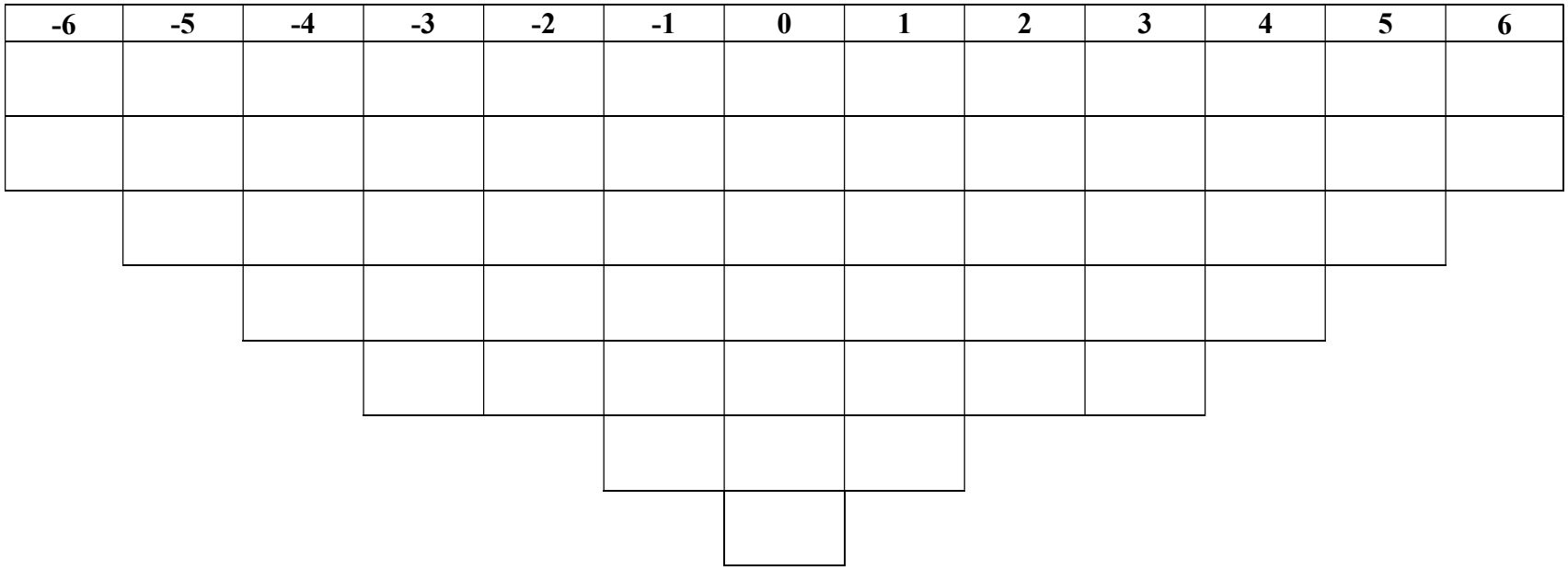
A.1: Q set statements

1. I think natural gas extraction and food production can exist in close proximity without problems.
2. Farmers need to be leaders when it comes to adapting to climate change.
3. I would avoid eating foods from farms that also allow natural gas drilling.
4. I am concerned about the impacts of shale gas development on public health.
5. Royalty payments from shale gas development have really increased inequality among farmers.
6. The gas industry helps preserve family farms and their way of life.
7. I'm worried about how shale gas development might compete with farming for resources like water and labor.
8. Struggling farmers might see a short-term boost from oil and gas leases, but the negative impacts will outweigh any benefits in the long run.
9. I worry that gas drilling could make organic growers living near drilling areas lose their certification.
10. Small family farms in this region are in a crisis, with farmers that are hanging on by a thread.
11. I see farming as an act of environmental stewardship.
12. Transitioning to sustainable, organic, and/or grass-fed production is a way for small family farms to stay viable in today's market.
13. We need affordable energy in order for farming to be profitable.
14. Organic and sustainable farming practices alone are insufficient to feed the world.
15. Environmentally sustainable farming practices are better for the land and the livestock.
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.
17. Farmers should be able to modernize their farms by making use of any available technology.
18. If a farmer says gas drilling has hurt their water or land, I believe them.
19. We need more research on the impacts of gas drilling on food and agriculture.
20. Nothing I've seen would indicate that gas drilling has any adverse effects.
21. If you think the oil and gas industry has the landowners' best interests in mind, you must believe in Santa Claus.
22. I generally find that the information provided through Cooperative Extension meets the needs of all serious farmers.
23. The gas industry has made shale gas extraction a much safer process over the last decade.
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.
25. Protecting our groundwater from contamination is crucial for the agricultural industry.
26. I am concerned that shale gas development could hurt property values.
27. Poorer rural communities are bearing the brunt of the negative impacts from natural gas extraction.

28. I'm worried that we are turning from an agricultural region into an industrial region.
29. Well-off "fracktivists" just want to keep the landscape looking a certain way.
30. Fracking has completely divided our local community.
31. I think everyone can agree that it is good for the U.S. to be less dependent on foreign oil.
32. Without fracking, a lot of farming communities would be dead in the water right now.
33. The gas companies are the experts when it comes to drilling – they know what they're doing.
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.
35. The media highlights a small number of residents with bad drilling experiences, rather than giving the entire picture.
36. If hydrofracking chemicals were truly dangerous, the government would have banned them.
37. I think local municipalities should be allowed to decide what is best for their community.
38. We should have a federal policy as a foundation for regulating shale gas development nationally.
39. The current oil and gas regulations are a joke – they contain far too many loopholes and exemptions for energy companies.
40. I support having some kind of tax or fee on natural gas drilling.
41. To grow business in the state, we need to get rid of burdensome regulations.
42. Fracking needs to be completely banned.
43. I think the debate over fracking has been more or less resolved at this point.
44. My relationship to the land is much different than it was before shale gas development started.
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.
46. I am confident that I am well educated about the hydraulic fracturing process and understand its effects.
47. I find that information about gas drilling from environmentalist groups relies more on emotion than science.
48. I think land grant college researchers in our state are biased towards gas drilling interests.
49. Fracking seems very polarized, but I think those are just a few extreme views being highlighted.
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.
51. The responsible approach is to exploit the benefits of shale gas while addressing its problems, rather than fighting it.
52. Natural gas can function as a "bridge fuel" to transition from fossil fuels to renewable energy.
53. I find other issues more environmentally worrisome than hydraulic fracturing.
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.
55. I think both pro- and anti-drilling groups are guilty of misrepresenting science to suit their arguments.
56. Landowners should have the right to lease the mineral rights on their private property.
57. I see family farms as the foundation of our country's heritage.

A.2: Q sort distribution board

Figure A.2.1: Forced choice frequency distribution board for Q set of 57 statements



← Most unlike your view

Most like your view →

A.3 Q sort instructions

Date:_____ Subject ID#:_____

The University of Georgia

University of Georgia Q Study Instructions and Survey:
Views on Natural Gas Development and Farming

Thank you for taking the time to help us understand different perspectives related to natural gas development and farming. Please use the instructions below to complete the Q sort. If you have any questions, just ask.

Instructions:

1. You will be considering each statement relative to how YOU view the relationship between unconventional natural gas development and farming in your community.
2. Remove the cards from the envelope. Each of the 57 cards contains one statement.
3. Read each statement. Then, *based on YOUR views about natural gas development and farming*, place each statement into one of three piles, attempting to make each pile approximately equal in size (about 19 statements per pile) HERE:

Most UNlike my view (about 19 statements here)	Neutral view about this statement (about 19 statements here)	**MOST Like** my view (about 19 statements here)

4. After sorting the statements, pick up the Most Like pile and distribute it on the distribution sheet. Put your top **TWO (2) MOST LIKE** statements in Position +6, then work your way to the 0 column.
5. Repeat with the UNLIKE pile, starting at -6, then with the Neutral pile.
6. Re-distribute the statements until you are satisfied with their placement.
7. Each square on the distribution sheet should only have one statement. Each statement is only used once.
8. Please complete the following survey.
9. Please complete the post-sort interview with the researcher.

Thank you for your participation!

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A.4 Post-Q sort questionnaire

Post-sort Survey

1. Age:

2. Gender:

3. Race/Ethnicity:

4. State and County of your current residence:

5. Levels of education completed (elementary, high school, college, post-graduate, etc.):

6. Please list any additional educational training you have received (e.g. workshops, trainings, etc.):

7. Occupation and Employer:

8. Length of time working in current occupation:

9. How would you describe your political views?

10. If you are a landowner, have you leased your subsurface rights for shale gas development?

A.5 Post-Q sort interview question prompts

A.5.1 Interview prompts for farmers

1. Please tell me about your background and the farm – how did you come to be a farmer?
    a. What is the history of your farm?
    b. Size of farm
    c. Production practices
2. What have your personal experiences been with shale gas development and "fracking" in the area?
    a. What are your memories of how the debate over fracking developed and played out in your community?
3. Where did/do you go to access information about shale gas development that you feel is accurate and trustworthy?
4. What role did Cooperative Extension play in educating farmers in the region about shale gas development?
    a. What have your experiences been like with Cooperative Extension overall?
5. Do you think the introduction of shale gas development has changed your relationship to the land or environment in any way? Why/Why not?
6. What do you think is the future of shale gas development in Pennsylvania/New York?
    a. Do you think the ban on fracking in New York is permanent?
7. Q sort questions
    a. Why are the statements you placed under +6 most like your view
    b. Why are the statements you placed under -6 most unlike your view?
    c. Why are the statements you placed under 0 most neutral to you? (Because you felt neutral about them, didn't have knowledge of them, both agreed and disagreed with parts of them, or other?)
    d. Do you think you would have sorted these statements differently ten years ago when the shale gas "boom" was starting? How?
    e. Are there any other statements you would like to discuss at this point?
    f. Were there any topics or statements about hydraulic fracturing and agriculture that you think should have been included, but weren't?
    g. On a scale of 1 to 10, with 1 being completely anti-drilling and 10 being completely pro-drilling, where do you see yourself on that scale?
8. Is there anything you would like to talk about that we haven't discussed yet?

A.5.2 Interview prompts for Cooperative Extension educators

1. Please tell me about your background – what is your current job?
    a. How did you come to be in your current profession?
2. What was it like in the early days of the fracking "boom" for you as a Cooperative Extension educator?
    a. What role did Cooperative Extension play for farmers at the start of the shale gas "boom"?
    b. Has that role changed over time?
    c. What role does Cooperative Extension play now?
3. From your perspective how has (or how could) shale gas development impacted farming and agricultural communities?
4. Where do you think extension agents, farmers, and policy makers should go to get trustworthy and accurate information about shale gas development?
5. What kind of research on shale gas and farming do you think is needed at this point?
6. Q sort questions
    a. Why are the statements you placed under +6 most like your view
    b. Why are the statements you placed under -6 most unlike your view?
    c. Why are the statements you placed under 0 most neutral to you? (Because you felt neutral about them, didn't have knowledge of them, both agreed and disagreed with parts of them, or other?)
    d. Do you think you would have sorted these statements differently ten years ago when the shale gas "boom" was starting? How?
    e. Are there any other statements you would like to discuss at this point?
    f. Were there any topics or statements about hydraulic fracturing and agriculture that you think should have been included, but weren't?
    g. On a scale of 1 to 10, with 1 being completely anti-drilling and 10 being completely pro-drilling, where do you see yourself on that scale?
7. Is there anything you would like to talk about that we haven't discussed yet?

A.5.3 Interview prompts for academic/land grant college researchers

1. Please tell me about your background – what is your current job?
    a. How did you come to be in your current profession?
2. What was it like in the early days of the fracking "boom" for you as a researcher?
    a. What role did Penn State/Cornell play during the fracking "boom"?
    b. How has that role changed over time?
    c. What role does the school play now?
3. From your perspective, how has (or how could) shale gas development impacted farming and agricultural communities?
4. How would you characterize the relationship between Penn State/Cornell and the shale gas industry?
5. How do you perceive the relationship between research and advocacy?
    a. Do you think researchers should get involved in advocacy for topics such as shale gas development?
6. What kinds of research on farming and shale gas development do you think is needed at this point?
7. What do you think is the future of hydraulic fracturing in Pennsylvania/New York?
    a. Do you think the ban on fracking in New York is permanent?
8. Q sort questions
    a. Why are the statements you placed under +6 most like your view
    b. Why are the statements you placed under -6 most unlike your view?
    c. Why are the statements you placed under 0 most neutral to you? (Because you felt neutral about them, didn't have knowledge of them, both agreed and disagreed with parts of them, or other?)
    d. Do you think you would have sorted these statements differently ten years ago when the shale gas "boom" was starting? How?
    e. Are there any other statements you would like to discuss at this point?
    f. Were there any topics or statements about hydraulic fracturing and agriculture that you think should have been included, but weren't?
    g. On a scale of 1 to 10, with 1 being completely anti-drilling and 10 being completely pro-drilling, where do you see yourself on that scale?
9. Is there anything you would like to talk about that we haven't discussed yet?

A.5.4 Interview prompts for Policy Makers

1. Please tell me about your background – what is your current profession?
    a. How did you come to be in your current (government) position?
2. What was it like in the early days of the fracking "boom" for you as a policy maker/someone involved in government?
3. How did you go about trying to make informed decisions about shale gas development?
4. Where do you think it is best to obtain trustworthy and accurate information about shale gas development and fracking?
5. What scale do you think is the most appropriate scale for regulating oil and gas activity (municipal, state, federal)? Why?
6. From your perspective, how has (or how could) shale gas development impacted farming and agricultural communities?
7. Q sort questions
    a. Why are the statements you placed under +6 most like your view
    b. Why are the statements you placed under -6 most unlike your view?
    c. Why are the statements you placed under 0 most neutral to you? (Because you felt neutral about them, didn't have knowledge of them, both agreed and disagreed with parts of them, or other?)
    d. Do you think you would have sorted these statements differently ten years ago when the shale gas "boom" was starting? How?
    e. Are there any other statements you would like to discuss at this point?
    f. Were there any topics or statements about hydraulic fracturing and agriculture that you think should have been included, but weren't?
    g. On a scale of 1 to 10, with 1 being completely anti-drilling and 10 being completely pro-drilling, where do you see yourself on that scale?
8. Is there anything you would like to talk about that we haven't discussed yet?

Appendix B:
Q Study Results

B.1 Factor Loadings

Table B.1.1: Factor loadings matrix

Q sort	Factor 1	Factor 2	Factor 3	Factor 4
1MP59E	0.6034*	-0.0903	0.4392	0.0966
2FP57E	0.4966	-0.2116	0.5068	0.2336
3MP41E	0.6697*	-0.0460	0.3494	0.1201
4MN540	*0.4467*	*0.2040*	*0.3952*	*0.2916*
5MP53E	*0.2549*	*-0.0806*	*0.3193*	*0.2542*
6MN51R	0.4506	0.5797*	-0.2370	-0.0945
7MN63E	0.6150*	0.3330	0.0767	0.0772
8FN56A	0.1571	0.7857*	-0.2547	-0.0145
9MP63CF	0.4212	-0.1359	0.5441*	0.0615
10MP54E	*0.4520*	*-0.1207*	*0.4102*	*0.0936*
11MP57R	0.6250*	0.2163	0.1546	0.3565
12MN48E	*0.4514*	*-0.0577*	*0.2036*	*0.4458*
13FP64AF	-0.1462	0.7592*	-0.2365	0.0608
14FN65E	0.5458*	0.4339	0.0060	0.1092
15MP49E	0.6245*	0.1696	0.2143	0.3087
16MN68AF	0.1903	-0.1051	0.5390*	-0.0035
17MP50F	0.5606*	0.0719	0.1584	0.3866
18MP75A	0.0125	0.7046*	-0.0581	0.0170
19MP52E	0.7215*	0.0149	0.2977	0.2328
20MP62F	0.1358	0.0238	0.2740	0.5204*
21MP45F	0.0376	0.3893	-0.1317	0.5778*
22BN59F	0.2815	-0.1585	0.4906*	0.4563
23BN61F	0.0764	-0.3299	0.5012*	0.1521
24MP72FA	*0.4678*	*-0.2321*	*0.3990*	*0.3673*
25MP62F	*0.2470*	*0.3365*	*-0.0374*	*0.3768*
26MN57F	0.1130	-0.0165	0.4968*	0.3520
27FN72F	-0.0632	0.822*2	-0.1283	-0.0849
28FN54F	0.2013	0.5284*	0.1469	0.3512
29MN46F	0.1414	0.7204*	-0.1818	0.1652
30FN55F	0.0994	0.7178*	-0.1496	0.1482
31MN70R	0.1517	0.7458*	0.0301	-0.1063
32BN48F	0.2605	0.6203*	0.1202	0.1534

Q sort	Factor 1	Factor 2	Factor 3	Factor 4
33MN56F	0.3358	-0.0127	0.0694	0.4950*
34MN62F	0.3579	-0.1381	0.4956*	0.2087
35MN37F	0.3670	0.0578	0.1702	0.7612*
36MP54F	0.1225	0.0250	0.3707	0.5939*
37FN63E	0.5117	0.6185	-0.0085	0.2156
38MP71R	*0.4354*	*0.0519*	*0.1330*	*0.3103*
39FP45R	0.5928*	0.2315	0.1118	0.0870
40FN530	0.7064*	0.0298	0.1982	0.0794
41MN55F	0.0994	0.1021	0.1229	0.5382*
42MN29F	0.0093	0.7400*	0.1371	-0.0219
43FN38AF	-0.0941	0.6644*	-0.3540	0.2432
44MP55F	0.2228	0.2606	0.2992	0.5688*
45FP62AF	-0.0635	0.6139*	-0.0985	0.0609
46MN67FC	0.1560	-0.1591	0.8158*	-0.0292
48MP57C	0.5768*	0.3301	0.2084	0.2948
49MP62C	0.1858	-0.2399	0.6298*	0.2772
51MN68F	0.1435	0.0221	0.6897*	0.2593
% explained variance	15	16	11	9

* Indicates a "defining sort" used to define that factor at a .48 significance level
Confounded Q sorts at .48 significance level indicated in underline
Insignificant sorts at .48 significance level indicated in *italics*

B.2 Factor Arrays

Figure B.2.1: Factor 1 array

-6	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**
42	56	8	30	32	4	57	35	31	46	15	55	24
3	36	41	54	22	27	17	12	1	10	53	25	45
	20	43	39	9	47	51	23	52	19	16	40	
		28	48	26	7	18	21	2	11	49		
			44	33	5	50	38	13	34			
					37	14	6					
						29						

Figure B.2.2: Factor 2 array

-6	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**
33	1	52	49	35	5	3	57	26	46	19	4	25
20	36	43	53	29	55	38	9	40	27	11	21	15
	6	51	47	14	34	16	30	28	7	18	42	
		23	32	56	13	24	31	37	2	8		
			54	41	50	17	39	10	12			
					22	48	45					
						44						

Figure B.2.3: Factor 3 array

-6	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**
3	8	28	5	37	12	16	38	17	6	13	31	46
42	9	43	4	19	33	50	53	15	56	10	23	11
	26	44	54	2	20	24	14	36	52	35	1	
		39	18	21	34	45	32	49	25	41		
			48	7	29	55	22	57	47			
					27	30	51					
						40						

Figure B.2.4: Factor 4 array

-6	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**
3	36	30	33	46	27	8	16	49	41	57	55	15
42	38	48	22	7	9	40	29	47	1	10	11	25
	43	44	20	34	4	39	21	18	17	56	31	
		26	14	28	32	35	45	24	19	12		
			50	6	5	37	52	51	54			
					23	13	53					
						2						

B.3 Statement rankings

Table B.3.1: Statement rankings by factor

Statements	Factor 1	Factor 2	Factor 3	Factor 4
1. I think natural gas extraction and food production can exist in close proximity without problems.	2	-5	5	3
2. Farmers need to be leaders when it comes to adapting to climate change.	2	3	-2	0
3. I would avoid eating foods from farms that also allow natural gas drilling.	-6	0	-6	-6
4. I am concerned about the impacts of shale gas development on public health.	-1	5	-3	-1
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-1	-3	-1
6. The gas industry helps preserve family farms and their way of life.	1	-5	3	-2
7. I'm worried about how shale gas development might compete with farming for resources like water and labor.	-1	3	-2	-2
8. Struggling farmers might see a short-term boost from oil and gas leases, but the negative impacts will outweigh any benefits in the long run.	-4	4	-5	0
9. I worry that gas drilling could make organic growers living near drilling areas lose their certification.	-2	1	-5	-1
10. Small family farms in this region are in a crisis, with farmers that are hanging on by a thread.	3	2	4	4
11. I see farming as an act of environmental stewardship.	3	4	6	5
12. Transitioning to sustainable, organic, and/or grass-fed production is a way for small family farms to stay viable in today's market.	1	3	-1	4
13. We need affordable energy in order for farming to be profitable.	2	-1	4	0
14. Organic and sustainable farming practices alone are insufficient to feed the world.	0	-2	1	-3
15. Environmentally sustainable farming practices are better for the land and the livestock.	4	6	2	6
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.	4	0	0	1
17. Farmers should be able to modernize their farms by making use of any available technology.	0	0	2	3
18. If a farmer says gas drilling has hurt their water or land, I believe them.	0	4	-3	2
19. We need more research on the impacts of gas drilling on food and agriculture.	3	4	-2	3

Statements	Factor 1	Factor 2	Factor 3	Factor 4
20. Nothing I've seen would indicate that gas drilling has any adverse effects.	-5	-6	-1	-3
21. If you think the oil and gas industry has the landowners' best interests in mind, you must believe in Santa Claus.	1	5	-2	1
22. I generally find that the information provided through Cooperative Extension meets the needs of all serious farmers.	-2	-1	1	-3
23. The gas industry has made shale gas extraction a much safer process over the last decade.	1	-4	5	-1
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.	6	0	0	2
25. Protecting our groundwater from contamination is crucial for the agricultural industry.	5	6	3	6
26. I am concerned that shale gas development could hurt property values.	-2	2	-5	-4
27. Poorer rural communities are bearing the brunt of the negative impacts from natural gas extraction.	-1	3	-1	-1
28. I'm worried that we are turning from an agricultural region into an industrial region.	-4	2	-4	-2
29. Well-off "fracktivists" just want to keep the landscape looking a certain way.	0	-2	-1	1
30. Fracking has completely divided our local community.	-3	1	0	-4
31. I think everyone can agree that it is good for the U.S. to be less dependent on foreign oil.	2	1	5	5
32. Without fracking, a lot of farming communities would be dead in the water right now.	-2	-3	1	-1
33. The gas companies are the experts when it comes to drilling – they know what they're doing.	-2	-6	-1	-3
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.	3	-1	-1	-2
35. The media highlights a small number of residents with bad drilling experiences, rather than giving the entire picture.	1	-2	4	0
36. If hydrofracking chemicals were truly dangerous, the government would have banned them.	-5	-5	2	-5
37. I think local municipalities should be allowed to decide what is best for their community.	-1	2	-2	0
38. We should have a federal policy as a foundation for regulating shale gas development nationally.	1	0	1	-5
39. The current oil and gas regulations are a joke – they contain far too many loopholes and exemptions for energy companies.	-3	1	-4	0

Statements	Factor 1	Factor 2	Factor 3	Factor 4
40. I support having some kind of tax or fee on natural gas drilling.	5	2	0	0
41. To grow business in the state, we need to get rid of burdensome regulations.	-4	-2	4	3
42. Fracking needs to be completely banned.	-6	5	-6	-6
43. I think the debate over fracking has been more or less resolved at this point.	-4	-4	-4	-5
44. My relationship to the land is much different than it was before shale gas development started.	-3	0	-4	-4
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.	6	1	0	1
46. I am confident that I am well educated about the hydraulic fracturing process and understand its effects.	3	3	6	-2
47. I find that information about gas drilling from environmentalist groups relies more on emotion than science.	-1	-3	3	2
48. I think land grant college researchers in our state are biased towards gas drilling interests.	-3	0	-3	-4
49. Fracking seems very polarized, but I think those are just a few extreme views being highlighted.	4	-3	2	2
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.	0	-1	0	-3
51. The responsible approach is to exploit the benefits of shale gas while addressing its problems, rather than fighting it.	0	-4	1	2
52. Natural gas can function as a “bridge fuel” to transition from fossil fuels to renewable energy.	2	-4	3	1
53. I find other issues more environmentally worrisome than hydraulic fracturing.	4	-3	1	1
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.	-3	-3	-3	3
55. I think both pro- and anti-drilling groups are guilty of misrepresenting science to suit their arguments.	5	-1	0	5
56. Landowners should have the right to lease the mineral rights on their private property.	-5	-2	3	4
57. I see family farms as the foundation of our country's heritage.	0	1	2	4

B.4 Consensus statements

Table B.4.1 Consensus statements shared by all factors

Statements	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-1	-3	-1

Table B.4.2 Consensus statements between F1 and F2

Statements	Factor 1	Factor 2
2. Farmers need to be leaders when it comes to adapting to climate change.	2	3
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-1
10. Small family farms in this region are in a crisis, with farmers that are hanging on by a thread.	3	2
11. I see farming as an act of environmental stewardship.	3	4
12. Transitioning to sustainable, organic, and/or grass-fed production is a way for small family farms to stay viable in today's market.	1	3
15. Environmentally sustainable farming practices are better for the land and the livestock.	4	6
17. Farmers should be able to modernize their farms by making use of any available technology.	0	0
19. We need more research on the impacts of gas drilling on food and agriculture.	3	4
20. Nothing I've seen would indicate that gas drilling has any adverse effects.	-5	-6
22. I generally find that the information provided through Cooperative Extension meets the needs of all serious farmers.	-2	-1
25. Protecting our groundwater from contamination is crucial for the agricultural industry.	5	6
31. I think everyone can agree that it is good for the U.S. to be less dependent on foreign oil.	2	1
36. If hydrofracking chemicals were truly dangerous, the government would have banned them.	-5	-5
38. We should have a federal policy as a foundation for regulating shale gas development nationally.	1	0
41. To grow business in the state, we need to get rid of burdensome regulations.	-4	-2
43. I think the debate over fracking has been more or less resolved at this point.	-4	-4
46. I am confident that I am well educated about the hydraulic fracturing process and understand its effects.	3	3
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.	0	-1
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.	-3	-3
57. I see family farms as the foundation of our country's heritage.	0	1

Table B.4.3 Consensus statements between F1 and F3

Statements	Factor 1	Factor 3
3. I would avoid eating foods from farms that also allow natural gas drilling.	-6	-6
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-3
7. I'm worried about how shale gas development might compete with farming for resources like water and labor.	-1	-2
10. Small family farms in this region are in a crisis, with farmers that are hanging on by a thread.	3	4
14. Organic and sustainable farming practices alone are insufficient to feed the world.	0	1
27. Poorer rural communities are bearing the brunt of the negative impacts from natural gas extraction.	-1	-1
28. I'm worried that we are turning from an agricultural region into an industrial region.	-4	-4
29. Well-off "fracktivists" just want to keep the landscape looking a certain way.	0	-1
37. I think local municipalities should be allowed to decide what is best for their community.	-1	-2
38. We should have a federal policy as a foundation for regulating shale gas development nationally.	1	1
39. The current oil and gas regulations are a joke – they contain far too many loopholes and exemptions for energy companies.	-3	-4
42. Fracking needs to be completely banned.	-6	-6
43. I think the debate over fracking has been more or less resolved at this point.	-4	-4
44. My relationship to the land is much different than it was before shale gas development started.	-3	-4
48. I think land grant college researchers in our state are biased towards gas drilling interests.	-3	-3
49. Fracking seems very polarized, but I think those are just a few extreme views being highlighted.	4	2
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.	0	0
51. The responsible approach is to exploit the benefits of shale gas while addressing its problems, rather than fighting it.	0	1
52. Natural gas can function as a "bridge fuel" to transition from fossil fuels to renewable energy.	2	3
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.	-3	-3

Table B.4.4 Consensus statements between F1 and F4

Statements	Factor 1	Factor 4
1. I think natural gas extraction and food production can exist in close proximity without problems.	2	3
3. I would avoid eating foods from farms that also allow natural gas drilling.	-6	-6
4. I am concerned about the impacts of shale gas development on public health.	-1	-1
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-1
7. I'm worried about how shale gas development might compete with farming for resources like water and labor.	-1	-2
9. I worry that gas drilling could make organic growers living near drilling areas lose their certification.	-2	-1
10. Small family farms in this region are in a crisis, with farmers that are hanging on by a thread.	3	4
15. Environmentally sustainable farming practices are better for the land and the livestock.	4	6
19. We need more research on the impacts of gas drilling on food and agriculture.	3	3
21. If you think the oil and gas industry has the landowners' best interests in mind, you must believe in Santa Claus.	1	1
22. I generally find that the information provided through Cooperative Extension meets the needs of all serious farmers.	-2	-3
25. Protecting our groundwater from contamination is crucial for the agricultural industry.	5	6
27. Poorer rural communities are bearing the brunt of the negative impacts from natural gas extraction.	-1	-1
29. Well-off "fracktivists" just want to keep the landscape looking a certain way.	0	1
30. Fracking has completely divided our local community.	-3	-4
32. Without fracking, a lot of farming communities would be dead in the water right now.	-2	-1
33. The gas companies are the experts when it comes to drilling – they know what they're doing.	-2	-3
35. The media highlights a small number of residents with bad drilling experiences, rather than giving the entire picture.	1	0
36. If hydrofracking chemicals were truly dangerous, the government would have banned them.	-5	-5
37. I think local municipalities should be allowed to decide what is best for their community.	-1	0
42. Fracking needs to be completely banned.	-6	-6
44. My relationship to the land is much different than it was before shale gas development started.	-3	-4
48. I think land grant college researchers in our state are biased towards gas drilling interests.	-3	-4
49. Fracking seems very polarized, but I think those are just a few extreme views being highlighted.	4	2

Statements	Factor 1	Factor 4
52. Natural gas can function as a “bridge fuel” to transition from fossil fuels to renewable energy.	2	1
55. I think both pro- and anti-drilling groups are guilty of misrepresenting science to suit their arguments.	5	5

Table B.4.5 Consensus statements between F2 and F3

Statements	Factor 2	Factor 3
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-3
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.	0	0
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.	0	0
29. Well-off "fracktivists" just want to keep the landscape looking a certain way.	-2	-1
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.	-1	-1
38. We should have a federal policy as a foundation for regulating shale gas development nationally.	0	1
43. I think the debate over fracking has been more or less resolved at this point.	-4	-4
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.	1	0
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.	-1	0
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.	-3	-3
55. I think both pro- and anti-drilling groups are guilty of misrepresenting science to suit their arguments.	-1	0
57. I see family farms as the foundation of our country's heritage.	1	2

Table B.4.6 Consensus statements between F2 and F4

Statements	Factor 2	Factor 4
5. Royalty payments from shale gas development have really increased inequality among farmers.	-1	-1
12. Transitioning to sustainable, organic, and/or grass-fed production is a way for small family farms to stay viable in today's market.	3	4
13. We need affordable energy in order for farming to be profitable.	-1	0
14. Organic and sustainable farming practices alone are insufficient to feed the world.	-2	-3
15. Environmentally sustainable farming practices are better for the land and the livestock.	6	6
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.	0	1
19. We need more research on the impacts of gas drilling on food and agriculture.	4	3
22. I generally find that the information provided through Cooperative Extension meets the needs of all serious farmers.	-1	-3
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.	0	2
25. Protecting our groundwater from contamination is crucial for the agricultural industry.	6	6
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.	-1	-2
36. If hydrofracking chemicals were truly dangerous, the government would have banned them.	-5	-5
39. The current oil and gas regulations are a joke – they contain far too many loopholes and exemptions for energy companies.	1	0
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.	1	1

Table B.4.7 Consensus statements between F3 and F4

Statements	Factor 3	Factor 4
1. I think natural gas extraction and food production can exist in close proximity without problems.	5	3
2. Farmers need to be leaders when it comes to adapting to climate change.	-2	0
3. I would avoid eating foods from farms that also allow natural gas drilling.	-6	-6
4. I am concerned about the impacts of shale gas development on public health.	-3	-1
5. Royalty payments from shale gas development have really increased inequality among farmers.	-3	-1
7. I'm worried about how shale gas development might compete with farming for resources like water and labor.	-2	-2
10. Small family farms in this region are in a crisis, with farmers that are hanging on by a thread.	4	4
11. I see farming as an act of environmental stewardship.	6	5
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.	0	1
17. Farmers should be able to modernize their farms by making use of any available technology.	2	3
26. I am concerned that shale gas development could hurt property values.	-5	-4
27. Poorer rural communities are bearing the brunt of the negative impacts from natural gas extraction.	-1	-1
28. I'm worried that we are turning from an agricultural region into an industrial region.	-4	-2
31. I think everyone can agree that it is good for the U.S. to be less dependent on foreign oil.	5	5
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.	-1	-2
37. I think local municipalities should be allowed to decide what is best for their community.	-2	0
40. I support having some kind of tax or fee on natural gas drilling.	0	0
41. To grow business in the state, we need to get rid of burdensome regulations.	4	3
44. My relationship to the land is much different than it was before shale gas development started.	-4	-4
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.	0	1
47. I find that information about gas drilling from environmentalist groups relies more on emotion than science.	3	2
48. I think land grant college researchers in our state are biased towards gas drilling interests.	-3	-4
49. Fracking seems very polarized, but I think those are just a few extreme views being highlighted.	2	2
51. The responsible approach is to exploit the benefits of shale gas while addressing its problems, rather than fighting it.	1	2
53. I find other issues more environmentally worrisome than hydraulic fracturing.	1	1

Statements	Factor 3	Factor 4
56. Landowners should have the right to lease the mineral rights on their private property.	3	4

B.5 Distinguishing statements

Table B.5.1 Distinguishing statements for Factor 1

Statements	**Factor 1**
6. The gas industry helps preserve family farms and their way of life.	0*
8. Struggling farmers might see a short-term boost from oil and gas leases, but the negative impacts will outweigh any benefits in the long run.	-4
12. Transitioning to sustainable, organic, and/or grass-fed production is a way for small family farms to stay viable in today's market.	1
13. We need affordable energy in order for farming to be profitable.	2
14. Organic and sustainable farming practices alone are insufficient to feed the world.	0
16. Educating farmers on improving their production practices is essential to the growth of our region's food system.	4*
18. If a farmer says gas drilling has hurt their water or land, I believe them.	0
23. The gas industry has made shale gas extraction a much safer process over the last decade.	1*
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.	6*
26. I am concerned that shale gas development could hurt property values.	-2
34. Cooperative Extension has been on the front lines of helping farmers in this area understand the benefits and risks of shale gas development.	3*
40. I support having some kind of tax or fee on natural gas drilling.	5*
41. To grow business in the state, we need to get rid of burdensome regulations.	-4
45. I think gas drilling is more accepted in areas with a heritage of extractive industry.	6*
47. I find that information about gas drilling from environmentalist groups relies more on emotion than science.	-1
53. I find other issues more environmentally worrisome than hydraulic fracturing.	4*
56. Landowners should have the right to lease the mineral rights on their private property.	-4
57. I see family farms as the foundation of our country's heritage.	1

$p < .05$; * denotes significance at $p < .01$

Table B.5.2 Distinguishing statements for Factor 2

Statements	Factor 2
1. I think natural gas extraction and food production can exist in close proximity without problems.	-5*
3. I would avoid eating foods from farms that allow natural gas drilling	0*
4. I am concerned about the impacts of shale gas development on public health.	5*
6. The gas industry helps preserve family farms and their way of life.	-5*
7. I'm worried about how shale gas development might compete with farming for resources like water and labor.	3*
8. Struggling farmers might see a short-term boost from oil and gas leases, but the negative impacts will outweigh any benefits in the long run.	4*
9. I worry that gas drilling could make organic growers living near drilling areas lose their certification.	1*
18. If a farmer says gas drilling has hurt their water or land, I believe them.	4
21. If you think the oil and gas industry has the landowners' best interests in mind, you must believe in Santa Claus.	5*
23. The gas industry has made shale gas extraction a much safer process over the last decade.	-4*
26. I am concerned that shale gas development could hurt property values.	2*
27. Poorer rural communities are bearing the brunt of the negative impacts from natural gas extraction.	3*
28. I'm worried that we are turning from an agricultural region into an industrial region.	2*
30. Fracking has completely divided our local community.	1
32. Without fracking, a lot of farming communities would be dead in the water right now.	-3*
33. The gas companies are the experts when it comes to drilling – they know what they're doing.	-6*
35. The media highlights a small number of residents with bad drilling experiences, rather than giving the entire picture.	-2*
37. I think local municipalities should be allowed to decide what is best for their community.	2*
39. The current oil and gas regulations are a joke – they contain far too many loopholes and exemptions for energy companies.	1
40. I support having some kind of tax or fee on natural gas drilling.	2
41. To grow business in the state, we need to get rid of burdensome regulations.	-2*
42. Fracking needs to be completely banned.	5*
44. My relationship to the land is much different than it was before shale gas development started.	0*
47. I find that information about gas drilling from environmentalist groups relies more on emotion than science.	-3*
48. I think land grant college researchers in our state are biased towards gas drilling interests.	0*
49. Fracking seems very polarized, but I think those are just a few extreme views being highlighted.	-3*

Statements	Factor 2
51. The responsible approach is to exploit the benefits of shale gas while addressing its problems, rather than fighting it.	-4*
52. Natural gas can function as a “bridge fuel” to transition from fossil fuels to renewable energy.	-3*
53. I find other issues more environmentally worrisome than hydraulic fracturing.	-3*
56. Landowners should have the right to lease the mineral rights on their private property.	-2*

$p < .05$; * denotes significance at $p < .01$

Table B.5.3 Distinguishing statements for Factor 3

Statements	Factor 3
4. I am concerned about the impacts of shale gas development on public health.	-3
6. The gas industry helps preserve family farms and their way of life.	3*
8. Struggling farmers might see a short-term boost from oil and gas leases, but the negative impacts will outweigh any benefits in the long run.	-5
9. I worry that gas drilling could make organic growers living near drilling areas lose their certification.	-5*
12. Transitioning to sustainable, organic, and/or grass-fed production is a way for small family farms to stay viable in today's market.	-1
13. We need affordable energy in order for farming to be profitable.	4*
14. Organic and sustainable farming practices alone are insufficient to feed the world.	1
15. Environmentally sustainable farming practices are better for the land and the livestock.	2*
18. If a farmer says gas drilling has hurt their water or land, I believe them.	-3*
19. We need more research on the impacts of gas drilling on food and agriculture.	-2*
20. Nothing I've seen would indicate that gas drilling has any adverse effects.	-1
21. If you think the oil and gas industry has the landowners' best interests in mind, you must believe in Santa Claus.	-2*
22. I generally find that the information provided through Cooperative Extension meets the needs of all serious farmers.	1*
23. The gas industry has made shale gas extraction a much safer process over the last decade.	5*
25. Protecting our groundwater from contamination is crucial for the agricultural industry.	3*
30. Fracking has completely divided our local community.	0
32. Without fracking, a lot of farming communities would be dead in the water right now.	1
33. The gas companies are the experts when it comes to drilling – they know what they're doing.	-1
35. The media highlights a small number of residents with bad drilling experiences, rather than giving the entire picture.	4*
36. If hydrofracking chemicals were truly dangerous, the government would have banned them.	2*
42. Fracking needs to be completely banned.	-6
46. I am confident that I am well educated about the hydraulic fracturing process and understand its effects.	6*

$p < .05$; * denotes significance at $p < .01$

Table B.5.4 Distinguishing statements for Factor 4

Statements	Factor 4
6. The gas industry helps preserve family farms and their way of life.	-2*
8. Struggling farmers might see a short-term boost from oil and gas leases, but the negative impacts will outweigh any benefits in the long run.	0*
18. If a farmer says gas drilling has hurt their water or land, I believe them.	2
20. Nothing I've seen would indicate that gas drilling has any adverse effects.	-3
23. The gas industry has made shale gas extraction a much safer process over the last decade.	-1*
24. I wish people would refrain from saying natural gas drilling is completely safe or completely dangerous.	2
30. Fracking has completely divided our local community.	-4*
43. I think the debate over fracking has been more or less resolved at this point.	-5
46. I am confident that I am well educated about the hydraulic fracturing process and understand its effects.	-2*
50. The results of government studies on gas drilling are based on the scientific findings of experts, rather than political ideology.	-3
54. I think hydraulic fracturing is still too new for there to be overwhelming consensus on its long term effects.	3*
57. I see family farms as the foundation of our country's heritage.	4*

$p < .05$; * denotes significance at $p < .01$