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Local Impacts of Unconventional Gas Development within Pennsylvania's Marcellus Shale Region: Gauging Boomtown Development through the Perspectives of Educational Administrators

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Using survey and interview data gathered from educators and educational administrators, we investigate school and community impacts of unconventional gas extraction within Pennsylvania's Marcellus Shale region. Respondents in areas with high levels of drilling are significantly more likely to perceive the effects of local economic gains, but also report increased inequality, heightened vulnerability of disadvantaged community members, and pronounced strains on local infrastructure. As community stakeholders in positions of local leadership, school leaders in areas experiencing Marcellus Shale natural gas extraction often face multiple decision-making dilemmas. These dilemmas occur in the context of incomplete information and rapid, unpredictable community change involving the emergence of both new opportunities and new insecurities.

Keywords boomtown, community impacts, economic development, education, Marcellus Shale, risk, schools, unconventional gas extraction

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Boomtowns are areas that have experienced rapid growth, and social, demographic, and economic change, generally as a consequence of natural resource development (Brasier *et al.* 2011; Brown, Dorius, and Krannich 2005; Jacquet 2009). Although multiple studies have cursorily explored the impacts of boomtown development on education and schooling (Cortese and Jones 1977; Freudenberg 1984; Pietens 1979) and many other studies have focused on social impacts more generally (Brasier *et al.* 2011; England and Brown 2003; Jacquet and Stedman 2011; Ruddell 2011; Ryser and Halseth 2011; Seyfrit and Sadler-Hammer 1988; Williamson and Kolb 2011), we are unaware of any research that systematically examines the perspectives of educators and educational administrators to assess the community impacts of boomtown development¹ and, specifically, by unconventional² gas extraction such as is occurring within Pennsylvania's Marcellus region.

Schools provide an instructive lens for understanding rapid community social, economic, and demographic change. First, because schools function as sites of civic interaction for local populations and educators directly and indirectly shape the career, residential, and educational aspirations of youth (Irvin *et al.* 2011), educators and educational administrators are in a unique position to help manage both the shorter and longer term changes associated with boomtown development. Second, schools are very likely to directly experience the effects of boomtown development if local population change, in turn, affects school enrollments and/or the specific needs of students and families. Finally, the school district provides a sociologically meaningful unit of analysis for understanding community change. Because educators work closely with youth and families from a wide range of backgrounds, school personnel can be especially keen observers of local change, providing important perspectives regarding the differential impacts on disparate segments of the local community (Schafft, Killeen, and Morrissey 2010).

In this article we analyze data from a survey of educators from across Pennsylvania's Marcellus Shale region, an area that in the last 5 years has experienced rapid social, economic, and environmental transformation associated with unconventional natural gas extraction. We supplement our survey data with interview and focus-group data conducted in several of Pennsylvania's Northern Tier counties,³ where some of the most intensive gas drilling has occurred. We use these data to investigate how educators perceive the effects of natural gas development on schools, and the localities they serve. We first discuss community change associated with Marcellus Shale gas development in Pennsylvania, reviewing the scholarship on boomtown development and community impacts. We then present analyses of our survey and qualitative data, looking in particular at educator perceptions of Marcellus Shale development impacts on community and school demographics, local economic conditions, and broader community infrastructure.

Boomtown Development in Pennsylvania's Marcellus Shale Region

The Marcellus Shale play extends from parts of Maryland, West Virginia, and Ohio, through about two-thirds of Pennsylvania, and into upstate New York. Until the last decade, drilling and extraction technologies were insufficiently developed to economically extract large amounts of gas from shale, even formations long known to contain significant quantities (Harper 2008). However, this changed in the late 1990s when two existing technologies were refined and adapted: horizontal directional drilling, and high volume hydraulic fracturing (Harper 2008). Wells are drilled

vertically to the targeted shale layer, where directional drilling then guides the drill bit laterally into the shale layer for up to a mile or more (Howarth, Ingraffea, and Engelder 2011; Lee et al. 2011). Water, containing sand or other proppants, along with chemical additives including friction reducers, corrosion inhibitors, and biocides, is injected into the well at high pressure and it fractures the shale, releasing the gas. The proppants help to hold the fractured shale layers apart, further facilitating the flow of gas. Although hydraulic fracturing used in conventional gas extraction (e.g., vertical wells in sandstone formations) typically uses tens of thousands of gallons of water, so-called unconventional gas extraction from shale using horizontal drilling and high-volume hydraulic fracturing can require between 4 and 10 million gallons of water (Abdalla 2010), of which 30%–70% may return to the surface through the well bore, where it must then be disposed of or recycled (Lee et al. 2011).

Between 320 and 1365 heavy equipment truck trips are required to build out and bring a single well into operation (Moss 2008). Current practices increasingly favor multiple wells on a single well pad, and by mid 2011, more than 80% of Marcellus wells were located on multiwell pads, most with between two and three wells, although well pads with between four and eight wells are not uncommon (Ladlee and Jacquet 2011). A standard well pad with three wellheads may therefore require 1,500–4,000 heavy equipment and tanker truck trips for well-pad construction, drilling, hydraulic fracturing, and hauling of wastewater. Additional construction and land impacts are associated with the build-out of pipelines and compressor stations.

While there are multiple domestic shale gas formations (Pifer 2011), most geologists contend that the Marcellus Shale play represents the largest unconventional gas reserve in the United States, and one of the largest in the world (Brundage et al. 2011; U.S. Energy Information Administration 2012). In Pennsylvania, the first unconventional Marcellus well began producing gas in 2005, while large-scale unconventional drilling began in earnest in 2007 (Harper 2008). By mid 2012 more than 5,500 wells had been drilled, with particular concentrations in the heavily rural areas of Pennsylvania's Northern Tier counties, as well as in the rural and suburban areas of the southwest corner of the state. While estimates vary (and the pace of development has also so far varied over time and across the region), as many as 60,000 or more wells are projected to be drilled in the Marcellus play in the coming decades (Howarth et al. 2011; Johnson 2010). This suggests that the shale boom in Pennsylvania is still in its early stages, raising critical questions about local effects, how communities might best manage shale development impacts, and how public policy may best foster longer term economic development while minimizing social and environmental disruption (Kay 2010; Pifer 2011).

In a recent review essay, Krannich (2012) offers several needed directions for scholarship on the social impacts of boomtown development. First, there is a basic need to document the ways in which "contemporary resource development activities may be similar to or different from those documented...during the 1970s and 1980s" (25). In contrast to the natural resource booms in the 1970s and 1980s, the technology in use for unconventional gas extraction is more intensive, requiring more inputs such as water, requiring fewer workers, and often necessitating a more transitory workforce (Filteau 2012), suggesting evolving characteristics of natural resource extraction activity and outcomes.

Krannich (2012) further argues that there is a need to better understand the ways that local and regional contexts may affect local change and adaptation to change. Evidence suggests that communities throughout the Northern Tier of Pennsylvania

are experiencing many of the social phenomena associated with previously documented boomtown development, although natural resource development within Pennsylvania's Marcellus region varies in some significant ways from the contexts documented in earlier boomtown studies in the West. First, while much of Marcellus development is occurring in more rural parts of the state, these communities are not characterized by the same spatial isolation. The settlement structure, even in the most sparsely populated parts of Pennsylvania, is made up of numerous small towns in relatively close proximity to larger population centers like Pittsburgh, Williamsport, and other urban areas that increasingly function as "staging areas" for industrial activity. Further, while unconventional gas development is occurring across Pennsylvania's Marcellus region, some areas have seen especially intense extraction activity while others have seen little or none.

Hence, this article has two principal objectives. The first is to examine the local perceptions of school leaders regarding three dimensions of change frequently identified in the boomtown literature: demographic change, economic impacts, and effects on local infrastructure (Brasier et al. 2011; Cortese and Jones 1977; Freudenberg 1984; Kay 2010; Pietens 1979; Williamson and Kolb 2011). Our second objective is to better understand the local context of development outcomes by paying analytic attention to the uneven expansion and outcomes of unconventional gas development across the Marcellus region in which some areas have experienced rapid and intense activity while other areas have remained largely on the peripheries of development.

Methods

The primary source of data for this article is a Web-based survey administered in mid 2011. Each of Pennsylvania's 500 school districts is directly affiliated with one of 29 "intermediate units," regional educational service agencies that make up a meso-level structure of the state's public education system. Seventeen intermediate units geographically coincide with the geography of the Marcellus Shale layer (see Figure 1). We surveyed all school district superintendents, high school principals, and high school directors of curriculum and instruction within those 17 intermediate units, resulting in a total sample population of 891 respondents from 309 school districts, from which we received a 42% response rate.

To compare the responses of surveyed participants from local areas differentiated by intensity of drilling activity, we used Pennsylvania Department of Environmental Protection data to identify geographic locations of Marcellus gas drilling. We then used geographic information system (GIS) software to calculate 10-mile buffer areas around the boundaries of each school district, determining the number of unconventional gas wells drilled within each school district area and buffer area as of July 2011, the approximate time of survey administration.

We identified all school districts that fell into the top quintile with regard to the number of unconventional gas wells. Those with 69 or greater Marcellus wells we classified as "higher intensity" districts, those with between one and 68 Marcellus wells we classified as "lower intensity" districts, and those districts with no wells within or near their geographies we identified as "no drilling" districts. We assessed differences in responses between groups using the Kruskal-Wallis test, a statistical test of significance similar to a one-way analysis of variance (ANOVA), used in circumstances in which the independent variable has two or more levels (in this case, level of drilling activity) and the dependent variable is ordinal (Siegel and Castellan 1998).

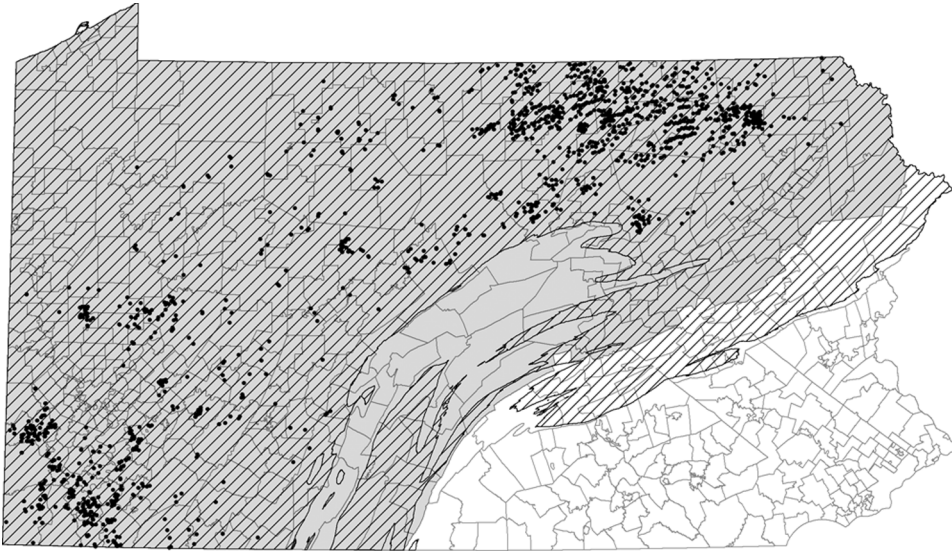


Figure 1. Map of Pennsylvania school districts showing Marcellus Shale coverage, area of survey administration, and Marcellus wells. Grayscale corresponds to the area of survey administration. Diagonal hatching corresponds to Marcellus Shale coverage.

We supplement the survey data with data from interviews and focus groups conducted with educators within Pennsylvania's Northern Tier counties,⁴ confining our sampling to Bradford and Tioga counties, the two counties in Pennsylvania's Northern Tier experiencing the heaviest drilling activity at the time of survey administration. Of the 10 school districts within these two counties, we were able to arrange focus groups and/or interviews within 8.⁵ Interviews were arranged one-on-one when possible and otherwise conducted as focus groups, at the discretion of the school district. Interviews and focus groups lasted 1–1.5 hours each and the same interview protocol was used for each.

Within each school district we requested to meet with the superintendent, the secondary school principal, a guidance and/or special education educator, and a school board member and/or business manager. Making our initial contacts through the district superintendent, we also expressed interest in speaking with school bus drivers, vocational educators, or others whom the superintendent believed might provide valuable perspectives on Marcellus Shale development and local change. In total we conducted 6 interviews and 7 focus groups with 41 individuals, including superintendents, high school and elementary school principals, school board members, transportation services workers, business managers, and others holding administrative and/or educational positions within the school district.⁶ Detailed summaries and field notes were written up from handwritten notes within 24 hours of all interviews and focus groups.

Recordings of the interviews and focus groups were transcribed. Loosely following a constant comparative method of data analysis (Corbin and Strauss 2008; Creswell 2013), transcriptions and field notes were open coded for perceptions of community change with particular focus on demographic, economic, and local infrastructural change, code categories suggested by previous boomtown scholarship as well as research by on Marcellus development-related community impacts (Brasier et al. 2011; Brown et al. 2005; Cortese and Jones 1977; Pifer 2011; Williamson and

Kolb 2011). We further coded axially, creating open code subcategories. For example, infrastructural change included changes in both physical and institutional infrastructure, as well as perceptions of and responses to those changes. We developed additional coded themes as they became apparent as patterns in the data, such as risk perception, inequality, and safety.

Our qualitative data represent the perspectives of school district personnel in only one highly impacted area of the state. Structural factors such as proximity to population centers and differing historical legacies of extractive activity may well help shape how local residents experience and evaluate natural resource development impacts (Brasier et al. 2011; Krannich 2012). Residents in Northern Tier counties, in comparison to counterparts in the southwest part of the state (another higher drilling activity area), may be more apt to report impacts, given their relative lesser experience with resource extraction and dispersed settlement structure. However, beyond a matter of degree, we do not have reason to believe that the experiences of the people we interviewed are substantively different from counterparts in other areas of the state similarly experiencing heavy drilling activity.

Results

Demographic and School Enrollment Change

As drilling activity began to rapidly expand, school administrators questioned what the effect might be on school enrollments, especially given the influx of gas industry workers from out of state (Brundage et al. 2011). One-quarter of survey respondents indicated that the influx of new people had a “substantial” or “major” effect on the local area, in contrast with only 2.9% of respondents in lower drilling intensity areas (see Table 1). As a business manager told us:

I think within the school we’re very concerned about the fact that there are thousands of people living in our town and our community. They

Table 1. Perceived local and school demographic impacts

	Local drilling activity		
	No drilling	Lower intensity	Higher intensity
<i>Percentage of respondents reporting that the following have already had a “substantial” or “major” effect on the local area as a consequence of Marcellus development:</i>			
New people moving into the area	1.4	2.9	25.4***
Changes in local population	1.3	1.1	11.6***
Increases in English language learner (ELL) populations	0	.5	5.6**
School enrollment increases	1.3	1.1	4.3
Changes in school population	1.3	1.0	4.2
N	90	203	79

Statistically significant at the .01 level of confidence. *Statistically significant at the .001 level of confidence.

are not residents . . . some people come here and stay in that “man camp,” or whatever it is, and they just stay and they go home for two weeks and come back. They really don’t reside here. They’re staying in a residential facility, like institutional-type setting . . . There are a whole lot of people that are not paying any taxes whatsoever because they’re not residents of Pennsylvania, and they’re not paying any income tax here, but they’re using all of our services, whether it be our roads, our police, our ambulance, our hospitals, our schools.

Of those workers who brought families and children with them, the perception among educators was that in most cases the families were characterized by their relative transiency and the disrupted educational experience of the children. A high school guidance counselor explained:

The kids come with their issues because a lot of them move around before they get here, so you get a transcript and the poor kid has been six different places and you’re trying to figure out what they need to, you know, get a well-rounded education while we have them and it’s hard to put the pieces together. They are behind academically.

Student movement across school districts is common in rural areas (Schafft et al. 2010), and many of the interviewees spoke of relying on peer and professional networks for easing administrative burdens. Students who move between adjacent or nearby districts generally can have records easily transferred, and school administrators can easily contact the previous school for information about the student needs. In contrast, students who are in transient gas worker families often do not have easily accessible files, are coming from locations with different academic expectations, and may only be in the district for relatively short periods of time.

However, despite some firsthand accounts of new students arriving with gas worker families, even in higher intensity drilling areas, less than 1 in 20 respondents reported substantial school enrollment increases. In interviews with school personnel, we similarly found that few administrators experienced enrollment increases that they directly attributed to the gas industry. The minimal impact on enrollments was surprising to many. A special education teacher told us:

I guess initially I thought that there would be—that, oh my goodness, all these students are gonna be coming into the high school, and do we have a big enough school, and you just initially you thought hundreds of students. In reality, we really haven’t seen a large influx because, I think it’s because the fathers will come up and stay and go back down.

This interviewee, restating what others had also expressed, described how the particular work environment in the Marcellus gas fields associated with the initial build-out was not only highly paid but also required 12-hour shifts for a week or more with a break for an equal amount of time, a work schedule tending to favor single and commuting workers. Among those workers from out of state with families, a common perception was that the high wages enabled many to fly home on off weeks. An interviewee, relating a conversation he had had with a drill rig worker, said, “The one guy I talked to says he saves up enough per diem money to pay for his flights back

and forth. He sees his family as much working here as he did when he was there. He liked it better because when he was there he was on call all the time. Now that he's here, when he flies back to Texas he is not on call for two weeks."

Pennsylvania State Department of Education data bear these perceptions out. In looking at net school enrollment figures between academic years 2007–2008 and 2009–2010, with only few exceptions, the dominant pattern is one of enrollment declines throughout most of the Marcellus region. Enrollment gains typically occurred far from any active drilling. Within the Marcellus Shale region most of the school districts experiencing net gains were those located in the southwest, particularly in some suburban areas surrounding Pittsburgh. Notably in the Northern Tier, in the areas of most intense drilling activity during this period, nearly all school districts show net declines rather than gains (see Figure 2).

Local Economic Impacts

In many of the most heavily impacted areas, especially within Pennsylvania's Northern Tier counties, communities have faced aging populations, stagnant economies, and youth outmigration for several decades. In the higher drilling intensity districts more than one-third of respondents noted significant local job and wealth creation, while more than 20% noted significant local economic growth (Table 2). More than 80% of respondents in higher intensity areas agreed or strongly agreed that the gas industry would have big effects on the local economy and workforce needs, and almost two-thirds believed that the industry would help the local area remain economically sustainable.

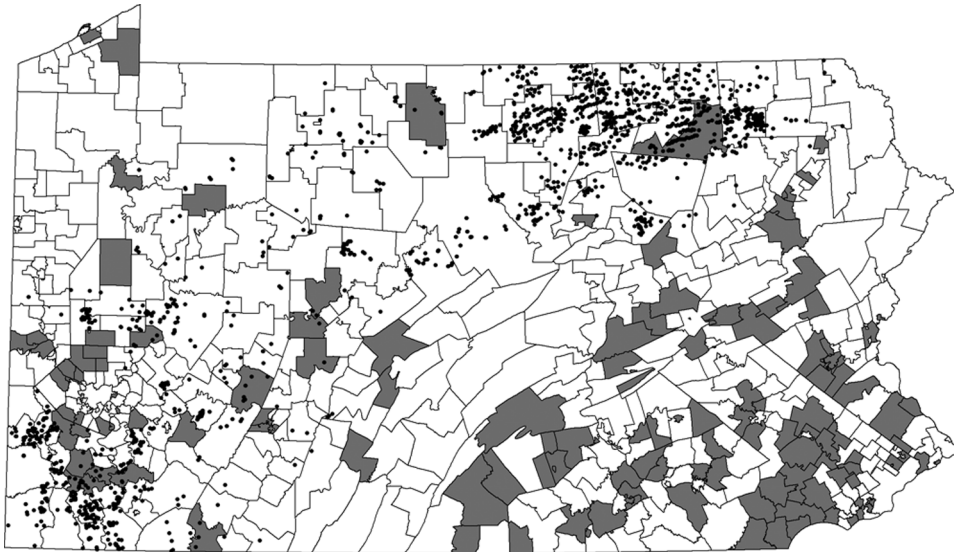


Figure 2. Location of Marcellus wells across Pennsylvania school districts through July 2011, with shaded areas indicating school districts experiencing net enrollment gains between academic years 2007–2008 and 2009–2010. All other districts experienced no gains or declined in student enrollments during this time period (Kelsey et al. 2012).

Table 2. Perceived local economic impacts

	Local drilling activity		
	No drilling	Lower intensity	Higher intensity
<i>Percentage of respondents reporting that the following have already had a “substantial” or “major” effect on the local area as a consequence of Marcellus development:</i>			
Job creation	4.2	6.8	33.8***
Local wealth creation	2.8	6.2	33.8***
Local economic growth	2.8	5.1	21.6***
<i>Percentage of respondents “agreeing” or “strongly agreeing” with the following statements:</i>			
Marcellus Shale natural gas development will have a big effect on our local economy.	36.4	58.3	82.4***
Marcellus Shale natural gas development will have a big effect on our local workforce needs.	45.3	65.0	82.4***
Marcellus Shale natural gas development will help this local area to remain economically sustainable.	24.7	43.7	60.8***
Most revenues generated from local Marcellus Shale natural gas development will NOT remain in the local economy.	64.3	63.5	60.0
The economic effects of Marcellus Shale natural gas development will probably be short-term rather than long-term.	34.7	33.9	37.1
Marcellus Shale natural gas development in this area will likely increase the gap between the “haves” and the “have nots.”	28.0	31.7	50.0**
<i>N</i>	90	203	79

Statistically significant at the .01 level of confidence. *Statistically significant at the .001 level of confidence.

Others, however, were not as optimistic. Across all district types, more than one-third of respondents believed that the economic impacts of the gas industry would be short-term rather than longer term:

We talk about our transient population with our kids sometimes, [but] the unnerving part is we’re not sure how transient this whole industry is. There’s rumors that they could pick up and leave or go somewhere else, or if there’s problems with water quality and you don’t see it, what happens when they do shut down for a while? Then there are some people that are benefitting. There are benefits. There’s jobs. There’s people here that are investing in water trucks and things like that that have really gone out on a limb with some loans and things like that. They could really be stuck if this is kind of a transient thing (and) that the bottom falls out.

Nearly two-thirds of respondents across all types of districts believed that most revenues generated from the gas industry would not remain local, and 50% of respondents from higher drilling intensity districts—almost twice the proportion of respondents from other district types—believed that industry development would increase local economic inequality. Further, many respondents who offered comments at the survey's end, consistent with many interviews and focus-group participants, noted that even schools in the midst of industry development and revenue generation were seeing few if any economic benefits. A superintendent in a district that has leased land for drilling told us:

I had a community meeting a couple weeks ago and one of the questions they asked was, “well, geez, you guys have the gas industry here now. You have, probably leased all your land and you’re probably getting all this income. Taxes. From these workers.” Wrong. We are getting zero. Now we did lease some of our acreage. For instance, we got 90,000 dollars for our one school, but we had to turn around and replace our condemned bleachers for 90,000 dollars. So, it’s not like it is helping our bottom line, it helped fix a situation we had to address, a one-time thing.

Pennsylvania schools receive 56% of their funding from local tax revenues, a higher percentage than only seven other states (U.S. Census Bureau 2011). Because of this, local revenues for schools have been an especially critical source of funding. In addition, Pennsylvania is the only major natural-gas-producing state lacking a severance tax (Wood and Ward 2009), which otherwise might supplement school budgets. The recently implemented “impact fee” does not funnel any revenues back to schools, and state school funding data do not suggest any significant Marcellus-associated economic benefits accruing to school districts (Kelsey et al. 2012). Because of these school-funding structures, the fiscal benefits to schools are limited beyond what increases may accrue from increased property values or the possibilities that school districts may have for leasing land for gas drilling.

Table 3. Other perceived local and community impacts

	Local drilling activity		
	No drilling	Lower intensity	Higher intensity
<i>Percentage of respondents reporting that the following have already had a “substantial” or “major” effect on the local area as a consequence of Marcellus development:</i>			
Road congestion and/or wear and tear	2.8	15.2	63.4***
Increases in housing rental prices	1.4	5.3	45.5***
Strains on local public services	1.4	3.6	43.6***
Housing shortages	1.4	5.1	35.9***
Displacement of low and fixed income residents	0	1.7	22.6***
Water and/or environmental quality problems	7.0	7.0	16.7***
N	90	203	79

***Statistically significant at the .001 level of confidence.

Community Infrastructure Impacts

Some of the most pronounced differences in survey responses across district types were associated with perceptions of impacts on community infrastructure, including housing and roads. Consistent with previous boomtown research (Housing Assistance Council 2000; Williamson and Kolb 2011), survey respondents from higher drilling intensity drilling areas were far more likely to note housing shortages, increases in rental costs, and the residential displacement of low- and fixed-income residents (see Table 3). In higher intensity districts, nearly 36% of respondents reported that housing shortages had a substantial or major effect on the local area. Similarly, more than 45% reported rental price increases. This is contrasted with lower intensity drilling districts in which only about 5% reported housing shortages, and no-drilling districts in which virtually no respondents reported significant gas industry impacts on housing and rents.

School personnel reported new homelessness, both among longer term residents who had found themselves displaced from rental housing and were forced to “double up” with friends or family, and among some gas worker families. Interviewees related how, due to federal statutes, students living in temporary or nonstandard housing, such as RVs, sometimes described as the “Hummer Homeless,” were technically and legally considered homeless⁷ and eligible for all services for homeless students, even if they came from families making substantial incomes associated with the gas industry and, as the apocryphal story goes, were driven to school in their parents’ Humvee. An elementary school principal explained:

Rentals of apartments and housing has skyrocketed, so people, our own native people who tend to be fairly transient moving from one place to another, can’t find anywhere to live. This is the first year, I’ve been in education for thirty-five years, this is the first year I’ve ever known of some of my students being homeless. In fact, I have a family that they have been evicted and they have to be out today and they don’t have anywhere to go. Also, a lot of these gas people bring fifth wheels or, uh, campers, and families are living in campers so we have a family with two or three kids and they’re living in the camper, which I can’t even imagine.

Industry-related road damage and transportation issues were identified as having a “substantial” or “major” effect on localities by nearly two-thirds of respondents in high drilling intensity districts, as compared to only about 3% of respondents in no-drilling areas and about 15% in lower intensity drilling areas. In interviews and focus groups, respondents in particular described traffic congestion in areas that previously had experienced very little traffic, and road deterioration as unprecedented heavy truck traffic damaged and in some cases destroyed roads.

Congestion and traffic also increased when damaged roads were rebuilt to withstand heavy equipment vehicles. An interviewee told us, “To travel these roads, one minute they become dirt or impassable from all the water trucks, and then they’re impassable because of all the construction crews [that] are on them, rebuilding them, and making them look beautiful with their signs around.” Respondents described safety concerns related to students walking to bus stops in areas of heavy truck traffic, and the unpredictability of industry-related traffic causing delays and disruptions to school bus routes. Many administrators reported building

relationships with gas industry representatives to better coordinate traffic patterns so that traffic could be minimized along school bus routes at the beginning and end of the school day.

Although environmental concerns have been at the center of much of the controversy around unconventional gas extraction (see, e.g., Howarth *et al.* 2011; Lee *et al.* 2011), even in the high drilling intensity districts only about 17% noted environmental impacts as having substantial or major local effects. One concern to emerge within the qualitative data was the risk of well water contamination for school buildings in rural districts where municipal water was not available. A superintendent told us, “There’s a lot of concern about water. We share that concern here. We have three wells. We have no municipal water. We’re out in the middle of nowhere.” In a fiscal environment in which Pennsylvania school districts have faced multiple budget cuts including a 7% cut of \$900 million in 2011 alone, and no significant tax revenue forthcoming (Kelsey *et al.* 2012), the opportunity to lease land for drilling is one that few school districts are likely to pass up, despite environmental risks. Interview and focus-group respondents in these districts in particular described the trade-offs between the real and potential economic benefits of leasing school land, and the risks of well-water contamination within school buildings.

Conclusions

Marcellus development has been hailed within Pennsylvania by some as “a once-in-a-generation energy and economic opportunity” (Pifer 2011, 660). Alternately, unconventional gas extraction has also been framed as representing unacceptable environmental risks with uneven economic benefits (Fox 2010; Kay 2010; Williamson and Kolb 2011). Contrary to the polarized viewpoints often popularly associated with Marcellus development (cf. Pifer 2011), attitudes toward Marcellus development cannot be dismissed as simply ideological, since our respondents tended to recognize both positive and negative impacts. By examining how local institutions are impacted by boomtown development, we are more clearly able to understand how natural resource booms are not monochromatic events within communities, but rather are characterized by contradictions, uncertainty, and the uneven distribution of opportunity and risk. Focusing on a concrete local institution, in our case the school district, enables us to explore how boomtown development might affect the economic and social conditions of people within and served by that institution, as well as the broader community.

One of the primary characteristics of boomtowns identified in earlier scholarship has been dramatic population growth accompanying natural resource “booms” (Freudenberg 1984; Seyfrit and Sadler-Hammer 1988). However, population booms within Pennsylvania’s Marcellus region do not appear as pronounced as in earlier studies. This may have partially to do with technological advances that reduce labor demand relative to the extraction activity (Krannich 2012). Likely, it is even more strongly connected with regional context, given that, unlike the settings of many earlier boomtowns studies in the Inter-Mountain West and the Great Plains where settlements are often remote and isolated, Pennsylvania’s settlement structure, even in its most rural areas, is characterized by numerous towns and settlements, typically with more densely settled urban areas within long-distance commuting range. This would presumably have a diminishing effect on pronounced local population growth and population impacts.⁸

However, despite the fact that few school districts had seen net enrollment increases, even in many of the areas experiencing the heaviest drilling activity, student turnover and changes in student demographics accompanying workforce change nonetheless occasionally can pose noticeable challenges within schools in the provision of academic services. More significant is the possibility that even though net enrollment increases do not appear to be associated with Marcellus development, enrollment turnover may be increasing as some relatively transient gas worker families enter school districts, and other households, especially those in the lower income brackets, are displaced due to tightened housing markets and rising rents. These are questions that bear further research, in particular in terms of the ways in which new forms of inequality, insecurity, and social exclusion may accompany rapid economic expansion.

Pennsylvania has proved a hospitable environment for the expansion of unconventional gas extraction. Tom Corbett, elected governor in 2010, has been a fierce advocate of Marcellus development, opening public lands to gas leasing, limiting regulation, and promoting strongly pro-business policies favoring gas development. Yet at the same time the 2011 state budget cut \$900 million in funding for public education. Further, the refusal to pass a severance tax means that school districts even in high-intensity drilling areas cannot expect to see significant increases in local revenue associated with gas development (Kelsey et al. 2012). Just as some individuals are favorably positioned to gain from Marcellus development because of leasing opportunities and/or access to new high-paying industry jobs, while others will experience new insecurities, school districts are arguably among the institutional “losers” in Pennsylvania’s gas boom, even as they are charged with the responsibility of workforce and youth development.

As unconventional gas development proceeds, recognizing and managing the various opportunities and risks associated with Marcellus development will be a critical part of attempts to translate short-term economic booms into longer term economic development and well-being for both families and communities. Successfully accomplishing this, however, involves understanding how these risks and opportunities are unevenly distributed over time and across community groups and institutions, and how new opportunities may also be simultaneously be accompanied by unanticipated and often unpredictable insecurities.

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Notes

1. See, however, Pietens (1979).
2. Conventional gas reservoirs are relatively limited in area within a geology and are dependent upon that geology to trap and contain gas within a rock formation. Unconventional gas reservoirs are those in which gas is contained throughout a geology, such as in

- gas-bearing shales, and require the use of specialized technologies for extraction, such as horizontal drilling combined with high volume hydraulic fracturing (Moss 2008).
3. Pennsylvania's Northern Tier refers to five counties located in north-central and north-eastern Pennsylvania along the New York border, including Bradford, McKean, Potter, Sullivan, Tioga, and Wyoming counties. The Northern Tier is characterized by its rurality, and recently by the rapid development of Marcellus Shale gas, especially in Bradford, Tioga, and Sullivan counties.
 4. The protocol we used for interviews and focus groups can be made available upon request from the lead author.
 5. We were unable to arrange interviews in the remaining two districts due to scheduling conflicts.
 6. We also conducted additional interviews and focus groups with county human services and housing authority workers, as well as the director of the regional career and technology center. While these additional interviews contributed to our background knowledge and tended to strongly corroborate what we learned from our school district contacts, in this article we draw only from our school district data in order to maintain consistency with the quantitative data.
 7. The McKinney–Vento Homeless Assistance Act of 1987 (reauthorized in 2002) defines homeless children as those who “lack a fixed, regular and adequate nighttime residence,” which includes children “doubling up” with other families or living in “motels, hotels, trailer parks, or campgrounds due to lack of alternative accommodations” (U.S. Department of Education 2002, 10,698).
 8. We are grateful to an anonymous reviewer for stressing this point.

References

- Abdalla, C. W. 2010. *Water withdrawals for development of Marcellus Shale gas in Pennsylvania*. Marcellus Education Fact Sheet. University Park, PA: Penn State College of Agricultural Sciences, Cooperative Extension.
- Brasier, K. J., M. R. Filteau, D. K. McLaughlin, J. Jacquet, R. C. Stedman, T. Kelsey, and S. J. Goetz. 2011. Residents' perceptions of community, and environmental impacts from development of natural gas in the Marcellus Shale: A comparison of Pennsylvania and New York Cases. *J. Rural Social Sci.* 26(1):32–61.
- Brown, R. B., S. F. Dorius, and R. S. Krannich. 2005. The boom-bust-recovery cycle: Dynamics of change in community satisfaction and social integration in Delta, Utah. *Rural Sociol.* 70(1):28–49.
- Brundage, T. L., T. W. Kelsey, J. Lobdell, L. L. Michael, J. Jacquet, J. R. Ladlee, J. F. Lorson, and T. B. Murphy. 2011. *Pennsylvania statewide Marcellus Shale workforce needs assessment*. Williamsport, PA: Marcellus Shale Education & Training Center.
- Corbin, J., and A. Strauss. 2008. *Basics of qualitative research*, 3rd ed. Thousand Oaks, CA: Sage.
- Cortese, C. F., and B. Jones. 1977. The sociological analysis of boomtowns. *Western Sociol. Rev.* 8(1):76–90.
- Creswell, J. W. 2013. *Qualitative inquiry & research design*, 3rd ed. Los Angeles: Sage.
- England, L., and R. B. Brown. 2003. Community and resource extraction in rural America. In *Challenges for rural America in the twenty-first century*, ed. D. L. Brown and L. E. Swanson, 317–328. University Park, PA: Penn State Press.
- Filteau, M. 2012. Who are those guys?: Transient gas workers in the Marcellus Shale region. Paper presented at the annual meeting of the Rural Sociological Society, Chicago, IL, August.
- Fox, J. (director). 2010. *Gaslands* [film]. Brooklyn, NY: International WOW Company.
- Freudenberg, W. R. 1984. Boomtown's youth: The differential impacts of rapid community growth on adolescents and adults. *Am. Sociol. Rev.* 49(5):697–705.
- Harper, D. 2008. The Marcellus Shale: An old “new” gas reservoir in Pennsylvania. *Penn. Geol.* 38(1):2–13.

- Housing Assistance Council. 2000. *Rural boomtowns: The relationship between economic development and affordable housing*. Washington, DC: Housing Assistance Council.
- Howarth, R. W., A. Ingraffea, and T. Engelder. 2011. Should fracking stop? *Nature* 477(7364): 271–275.
- Irvin, M. J., J. L. Meece, S. Byun, T. W. Farmer, and B. C. Hutchins. 2011. Relationship of school context to rural youth's educational achievement and aspirations. *J. Youth Adolescence* 40(9):1225–1242.
- Jacquet, J. 2009. *Energy boomtowns & natural gas: Implications of Marcellus Shale for local governments & rural communities*. NERCRD Rural Development Paper No. 43, January. University Park, PA: The Northeast Regional Center for Rural Development. http://aese.psu.edu/nercrd/publications/rdp/rdp43/at_download/file.
- Jacquet, J., and R. C. Stedman. 2011. Natural gas landowner coalitions in New York State: Emerging benefits of collective natural resource management. *J. Rural Social Sci.* 26(1):62–91.
- Johnson, N. 2010. *Pennsylvania energy impacts assessment: Marcellus Shale natural gas and wind*. Arlington, VA: The Nature Conservancy.
- Kay, D. 2010. *The economic impact of Marcellus Shale gas drilling: What have we learned. What are the limitations?* Working Paper Series: A comprehensive Economic Impact Analysis of Natural Gas Extraction in the Marcellus Shale. Ithaca, NY: Cornell University Department of City and Regional Planning.
- Kelsey, T. W., W. Hartman, K. A. Schafft, Y. Borlu, and C. Costanzo. 2012. *Marcellus Shale gas development and Pennsylvania school districts: What are the implications for school expenditures and tax revenues?* Penn State Extension Marcellus Education Fact Sheet. University Park, PA: The Pennsylvania State University.
- Krannich, R. S. 2012. Social change in natural resource-based rural communities: The evolution of sociological research and knowledge as influenced by William R. Freudenberg. *J. Environ. Stud. Sci.* 2:18–27.
- Ladlee, J., and J. Jacquet. 2011. *The implications of multi-well pads in the Marcellus Shale*. Cornell University Community and Regional Development Institute Research and Policy Brief Series 43:1–4. Ithaca, NY: Cornell University Community and Regional Development Institute. cce.cornell.edu/EnergyClimateChange/NaturalGasDev/Documents/PDFs/Policy_Brief_Sept11-draft02.pdf
- Lee, D. S., J. D. Herman, D. Elsworth, H. T. Kim, and H. S. Lee. 2011. A critical evaluation of unconventional gas recovery from the Marcellus Shale, northeastern United States. *KSCE J. Civil Eng.* 15(4):679–687.
- Moss, K. 2008. *Potential development of the natural gas resources in the Marcellus Shale: New York, Pennsylvania, West Virginia and Ohio*. Denver, CO: National Park Service, U.S. Department of the Interior, Geologic Resources Division.
- Pietens, B. 1979. Some facts about boom town education. In *Boom towns and human services*, eds. J. A. Davenport and J. Davenport, 49–62. Laramie, WY: University of Wyoming Department of Social Work.
- Pifer, R. H. 2011. What a short, strange trip it's been: Moving forward after five years of Marcellus Shale development. *Univ. Pittsburgh Law Rev.* 72(615):615–660.
- Ruddell, R. 2011. Boomtown policing: Responding to the dark side of resource development. *Policing* 5(4):328–342.
- Ryser, L., and G. Halseth. 2011. Housing costs in an oil and gas boom town: Issues for low income senior women living alone. *J. Housing Elderly* 25(3):306–325.
- Schafft, K. A., K. M. Killeen, and J. Morrissey. 2010. The challenges of student transiency for rural schools and communities in the era of No Child Left Behind. In *rural education for the twenty-first century: Identity, place, and community in a globalizing world*, ed. K. A. Schafft and A. Y. Jackson, 95–114. University Park, PA: Penn State Press.
- Seyfrit, C. L., and N. C. Sadler-Hammer. 1988. Social impact of rapid energy development on rural youth: A statewide comparison. *Society Nat. Resources* 1:57–67.

- Siegel, S., and N. J. Castellan, Jr. 1998. *Nonparametric statistics for the behavioral sciences*, 2nd ed. New York, NY: McGraw-Hill.
- U.S. Census Bureau. 2011. *Public education finances: 2009*. Washington, DC: U.S. Census Bureau.
- U.S. Department of Education. 2002. McKinney-Vento education for homeless children and youths program. *Fed. Reg.* 67(46):10,697-10, 701.
- U.S. Energy Information Administration. 2012. *Annual energy outlook 2012 early release overview*. Washington, DC: U.S. Department of Energy.
- Williamson, J., and B. Kolb. 2011. *Marcellus natural gas development's effect on housing in Pennsylvania*. Williamsport, PA: Lycoming College Center for the Study of Community and the Economy.
- Wood, M., and S. Ward. 2009. *Responsible growth: Protecting the public interest with a natural gas severance tax*. Harrisburg, PA: Pennsylvania Budget and Policy Center.