



Pittsburgh,  
the Pittsburgh of Appalachia  
*A geography of power and extraction*

February 2019

UrbanKind  
I N S T I T U T E

Pittsburgh, the Pittsburgh of Appalachia:  
A geography of power and extraction

Jason Beery, Ph.D.

UrbanKind Institute

Author's Note and Disclaimer

Thanks to Colleen Cain, PhD and Jamil Bey, PhD of UrbanKind Institute, Jill Kriesky, PhD of Southwest Environmental Health Project, and Blessy Bellamy, M.S., for their comments. Thanks also to Veronica Coptis, Executive Director of Center for Coalfield Justice, and Jennifer Baka, Assistant Professor of Geography at Pennsylvania State University, for early conversations about several of the themes in this paper.

*Pittsburgh, the Pittsburgh of Appalachia* is the second essay of the “Environment, Politics, and Power in Pittsburgh, not Paris” series. Support for this essay comes from a grant from the Heinz Endowments.

UrbanKind Institute is a think-and-do tank advancing practices, policies, and programs that are kind to urban people and environments.

Opinions or points of view expressed herein represent those of the author and are presented for informational purposes to expand the space for conversations around equity, justice, and inclusion in the Pittsburgh region. Opinions and recommendations do not necessarily represent or constitute approval, adoption, or endorsement by any of our funders or partners.

Correspondence concerning this article should be addressed to UrbanKind Institute, 212 Brownsville Rd., Pittsburgh, PA 15210. Alternatively, you may contact UrbanKind Institute electronically: [info@urbankind.org](mailto:info@urbankind.org).

## Pittsburgh, the Paris of Appalachia

When writer Chuck Kinder was asked why he coined the nickname “The Paris of Appalachia” for Pittsburgh, he answered that there was a vibrant literary scene in the city and there was “some sort of a romantic aura about Pittsburgh.” He poetically continued, likening the romantic ambiance of Pittsburgh’s old houses, neighborhoods, cultural history, rivers, and bridges to the “glittering romance of dark, rainy, lamp-lit Left Bank cafe nights and the salon glamour” of 1920s Paris.<sup>1</sup>

The “Paris of Appalachia” nickname has become a popular way of highlighting the relationship between Pittsburgh and the wider region (though sometimes it is used sarcastically or cynically). Some references to it follow Kinder’s emphasis on arts and culture,<sup>2</sup> while others use it more broadly to explore other aspects of the city-region relationship. Perhaps most notably, Brian O’Neill celebrates the everyday culture of Pittsburgh in his 2009 book *The Paris of Appalachia*. In it, he recognizes that people, money, and other things move across and between multiple municipalities. As he explains:

As anyone who has lived here for more than a half-hour can tell you, the real Pittsburgh is not confined by the city limits. One of every four jobs in the seven-county area is within three miles of the Point, but most of those paychecks are spent in the malls and superstores of the suburbs . . . The real Pittsburgh stretches from Peters

through Cranberry, from Murrysville to Hopewell, and to points beyond.<sup>3</sup>

O’Neill pushes the reader to think about the many ways that the city, suburbs, and region are politically, economically, and socially connected.

This broader thinking about how Pittsburgh, the Paris of Appalachia, is connected with—and central to—the Appalachian region that surrounds it is essential for understanding the city’s role in regional environmental politics as well. Indeed, the first essay in this series, *The Fierce Urgency of Our Environmental Now*, pointed out connections between Pittsburgh, the development of the regional petrochemical industry, and climate change. The essay explained how climate change will affect both urban and rural areas and how regional petrochemical industry facilities based *outside* of the city will affect environmental quality *inside* the city.

This essay looks at the relationship in the opposite direction. Broadly speaking, what role does Pittsburgh have in shaping environmental and economic outcomes in Appalachia historically, today, and tomorrow? This essay is a response to the tendency of politicians, policy-makers, city boosters, and others to promote the City of Pittsburgh as representative for the entire region or to ignore the many ways that the city and region are connected.<sup>4</sup> For instance, writing the day after Trump and Peduto’s “Pittsburgh, not Paris” exchange, CityLab contributor

Andrew Small pointed out that Peduto’s emphasis on city limits in his tweets and television interviews that followed “blurs the idea that Pittsburgh’s public policy concerns—as a place, as an economy, and most pertinently to this discussion, as a contributor to climate change—extend beyond the city itself.”<sup>5</sup> Such emphasis on the city over the region minimizes the important ways that they are connected.

How we understand this relationship between Pittsburgh and the region informs two things: how we think about the perceived and real tensions between the two areas and how we think about our environmental and economic future—particularly in regards to shale gas and petrochemical development. We need to recognize that:

1. Economic processes cross city, county, and metropolitan statistical area boundaries,
2. Cities *depend* on social and environmental processes inside *and* outside of their borders to function,
3. Resource extraction and transformation are integral to economic activity, and
4. The process of resource extraction, transformation, and flow management are filled with power dynamics that affect who benefits and who loses and in what way.<sup>6</sup>

Considering the city-regional relationship in this way opens an important conversation about how power operates across space and how power shapes—and continues to shape—Pittsburgh and Appalachia. It enables us to think about

the historical and contemporary connections between the city and region, how power operates within those connections, and who benefits and who loses from economic and environmental processes. These aspects of the relationship (though seldom discussed) are critical to how we in the city understand, listen to, and work *with* our regional counterparts in developing healthy and secure environmental and economic futures.

Illustrating this perspective, Part 1 explores the history of connections between Pittsburgh and Appalachia and how economic power led to uneven outcomes for the two areas.<sup>7</sup> This history of uneven connections provides a more thorough context for understanding the contemporary development of shale gas extraction and the petrochemical industry. Part 2 examines shale gas extraction through this lens. The conclusion then reconsiders how we think about Pittsburgh, the Paris of Appalachia, and what global investment in regional petrochemical plants may mean for the relationship between the city, region, and our shared economic and environmental future.

## PART 1 A Brief History of Uneven Connections

Throughout its history, Pittsburgh, like other cities,<sup>8</sup> has been tied to its surrounding region. Extracting, using, and managing resources from outside of the

city and Allegheny County has been central to the city and region's growth.<sup>9</sup> In Pittsburgh's very early days, Pittsburgh and the other towns along rivers and roads throughout the region drew mainly from the agricultural lands and raw materials that immediately surrounded them. Although connected, they grew somewhat independently.<sup>10</sup> As trade and manufacturing industries developed in Pittsburgh, other cities and towns competed to lead the trade and industrial development in the region.

During the mid- and late-1800s, the rise of heavy industry brought changes to the relationship between Pittsburgh and Appalachia. Economic and political leaders based in (or near) Pittsburgh since that time have shaped and reshaped the landscape of the region to enable the growth and transformation of the city—often to their own benefit.<sup>11</sup> Drawing on the work of several historians, this section highlights this relationship during the region's industrial heyday in the late 1800s and the "Pittsburgh Renaissance" of the mid-to-late 1900s. Our history of uneven connections sets the stage for thinking about the city, region, and shale gas extraction and processing today.

### **Industrial expansion: late 1800s**

The transformation of Pittsburgh's economy from one based on river commerce and trade to one based on large-scale industrial production and resource extraction brought changes in the relationship between the city and region. These changes led towards the

increased dominance of Pittsburgh, its companies, and industrialists over the rest of the region.<sup>12</sup> Among other areas, we see this relationship in two of the most central materials in the region's history: coal and water.

#### *Coal*

As the city and industry expanded in the mid-1800s, coal replaced timber as the dominant fuel source. Coal came from mines throughout the region: the Pittsburgh coal seam extended from Pittsburgh south to central West Virginia and southeastern Ohio. The most refined coal came from the Connellsville coal seam in Fayette and Westmoreland Counties. With the shift to coal, the region transformed: large ovens and plants opened near the mines in order to more cheaply transform the coal into coke, a purified carbon fuel used in iron-making. There, the volatile chemicals in the coal were burned off and released into the air.<sup>13</sup>

These ovens and plants heavily polluted the adjacent company "patch towns" that housed workers and their families in cheap wooden dwellings and sold them necessary goods at the company store. Conditions were not healthy. In these towns throughout the region, workers and their families were exposed to various forms of pollution from the mines.<sup>14</sup> Once processed, the coke was sent by river and rail to Pittsburgh and its neighbors for use in industrial production. As the mines, coking plants, and iron and steel

manufacturing expanded in the second half of the 19<sup>th</sup> century, a “regional urban network of towns” arose to service the coal and coke industry with administrative and mechanical support. At the center of this network was Pittsburgh.<sup>15</sup>

As Pittsburgh’s iron industries began to grow, industrial organizational changes consolidated regional power in Pittsburgh. Pittsburgh’s budding industrialists, such as James L. Laughlin and Andrew Carnegie, diversified and expanded their investments into different parts of the production process, into new technologies, and into railroads, often combining them in one company. This integration of activities into single companies lowered production and labor costs and stifled competition.<sup>16</sup> By the time he sold his steel company in 1901, Carnegie had “created a vast steel empire, centered in Pittsburgh, with an enormous array of iron and coal mines, railroad links, furnaces and rolling mills that allowed for the transformation of raw materials into finished products by all Carnegie-controlled companies.”<sup>17</sup> This consolidation of control over all aspects of industrial production—from the mining to the milling to the transport—led to a consolidation of power in Pittsburgh, the city now centrally connected to the rest of the region by both boat and railroad.

### *Water*

Water served as both a means of transportation and as a resource for industrial processes. As such, it was

central to economic growth and expansion. In the city’s early days, the rivers varied from being too shallow to too high. To be most useful, the rivers needed a steady flow to allow for navigation and to prevent flooding. Maintaining a steady flow of water on rivers was crucially important.<sup>18</sup> That required the transformation of near and distant landscapes.

Since the late 1700s, the federal, state, and city governments and other leaders worked to ensure a steady flow and to prevent flooding. Early attempts to manage the river’s flow included clearing and deepening of river channels and building a few locks and dams on the Youghiogeny and Monongahela Rivers upstream from Pittsburgh. During the later 1800s, the Army Corps of Engineers constructed an expansive system of locks and dams up and down the Ohio, Allegheny, and Monongahela Rivers.<sup>19</sup>

Despite these efforts, floods continued. Between 1832 and 1907, the City of Pittsburgh experienced seven large floods, including a major one in 1907. These floods not only caused property damage, injury, and death, they also disrupted the industrial operations along the riverbanks, leaving factories and workers idle.<sup>20</sup>

In response to the 1907 flood, the city’s Chamber of Commerce created a flood commission to look at ways to prevent future flooding in the city. The commission produced a report in 1912 that called for a series of projects that would better protect the city from flooding. One proposed project was the

creation of forest preserves at the headwaters of the Allegheny and Monongahela Rivers.<sup>21</sup> The year before, the U.S. Congress passed the Weeks Act, which allowed the U.S. Government to purchase private property at the headwaters of rivers (which had been massively deforested) to ensure steady flows and successful commerce downstream. For Pittsburgh, this proposal and the federal legislation led to the creation of Monongahela National Forest in West Virginia in 1920 and Allegheny National Forest in northern Pennsylvania in 1923—at or near the headwaters of the Monongahela and Allegheny Rivers, respectively.<sup>22</sup> Through the creation of these national forests, large tracts of land far away from Pittsburgh and Allegheny County’s factories also became central tools in managing Pittsburgh’s water and in enabling the city’s economic activities. Put another way, Pittsburgh’s economic growth and success has required the transformation of rivers and land throughout the region—upstream from northern Pennsylvania and eastern West Virginia and downstream to Ohio.

### *A Central Pittsburgh*

With the growth of industry in Pittsburgh and neighboring mill towns, the city’s connections with the region expanded. At the same time, its *footprint* on the region expanded. Commercial and industrial processes in Pittsburgh enrolled material resources, river flows, and labor from throughout the wider

region. During the industrial age of the late 1800s and early 1900s, the physical landscape and workers’ lives across the region were central to the production and expansion of the city’s wealth and the fortunes of its elite.

The relationship was about more than just connections, however. It was about power and control. As historian Allen Dieterich-Ward summarizes in his recent book *Beyond Rust*, the rise of industrial cities, such as Pittsburgh, could only happen “as residents from throughout expanding economic regions used urban capital to exploit rural areas even as they *centralized* control of those natural and human resources into city centers.”<sup>23</sup> That is, business people and others throughout the region used money from Pittsburgh to extract local resources and to make small fortunes, but, at the same time, industrialists in Pittsburgh increased their power over workers and environments in the region. Pittsburgh industrialists controlled the region. In this way, the resources and the value that workers created across the region funneled into Pittsburgh where corporate executives, managers, financiers, and others amassed wealth.

In sum, *outside* the city, the region’s environment was transformed and polluted and the economic benefits were mixed. *In* the city, profit from and control over the region increased. This is a—if not the—central pattern that runs through the region’s history. As the next section shows, that pattern varies over time.

## The Pittsburgh Renaissance and beyond

During the first decades of the 1900s, businesspeople, planners, and city officials grew concerned about the effects of industrial pollution on health, downtown real estate values, and the city's economic future.<sup>24</sup> By the time of the Second World War, Pittsburgh's dominant corporations could "no longer tolerate the conditions they had created and that depression and war had exacerbated." Some—U.S. Steel, Westinghouse, and Alcoa—even threatened to leave.<sup>25</sup>

To address the city's pollution and economic future, Richard King Mellon with the Allegheny Conference on Community Development and Mayor David L. Lawrence with the City of Pittsburgh, led the "Pittsburgh Renaissance". This effort sought to remake the landscape of the city *and* region to foster economic growth. The city leaders behind the effort desired to transform the industrial city into a mixed-economy city that was attractive to corporate offices and white-collar workers.

Transforming the city in that way meant cleaning up and reconfiguring downtown. It meant increasing access via new highways to green and healthy suburbs on hilltops instead of in industrial valleys. It also meant creating parks, such as Ohiopyle and McConnell's Mill, outside of the city where the new upper and middle-class workers could reconnect with nature in their leisure

time. In the city during the 1950s and 1960s, they transformed the Point from an industrial area into a park and the Lower Hill District from a predominantly Black neighborhood into a civic center. To make this environmental and economic transformation of the city possible, however, they first needed to clean the city's air and prevent flooding. This again meant transforming the region—while still benefitting from its industrial activities.<sup>26</sup>

### *Cutting coal, cleaning air*

After the war, the city implemented smoke control legislation that restricted individual and household burning of coal. Within a few years, there was a visible improvement in the city's air.<sup>27</sup> That coal, however, had been mined throughout the region. Since the natural gas that replaced coal for home heating came from the southwest U.S., the Pittsburgh region's coal production declined. That decline in demand from city residents further disconnected them from rural residents who had depended on that urban market.<sup>28</sup>

While the air in the city improved, air quality in mill towns and river valleys continued to contain hazardous chemicals. A notorious example occurred in Donora in October 1948. There, air laden with toxic chemicals from a U.S. Steel subsidiary's zinc works was trapped at ground level. It killed 22 people immediately and likely led to the premature death of many others in the following month and after.<sup>29</sup>



### *Controlling floods, displacing people*

Additionally, transforming the city, especially downtown, was not going to be possible without improved flood controls. Despite previous efforts, flooding continued. The infamous 1936 flood showed how vulnerable the Point, downtown, and the riverbanks still were. Following that flood, the city's political and civic elite pushed again for the construction of new dams and reservoirs upstream (and well outside of the city limits). Between 1936 and 1953, 18 new flood control reservoirs were built. Their construction displaced rural residents and submerged rural villages.<sup>30</sup> Notably, city political and economic elites pushed for the construction of the Kinzua Dam and Allegheny reservoir near the New York State border. Their plan faced up against the wishes and land claims of the Onöndowa'ga:' (Seneca Nation). In the early 1960s, approximately 600 Seneca were forced out of their ancestral homes in order to flood the reservoir.<sup>31</sup> The transformation of rural landscapes and the displacement of rural residents secured a steady and manageable flow of water into the city. With the air cleaner and the rivers controlled, the city's elites could continue their plans for transforming the city.<sup>32</sup>

### *Continued sacrifice*

Even as they advocated for a clean city, several proponents of the Pittsburgh Renaissance continued to profit from industrial and extractive "sacrifice zones"

across the region. In such sacrifice zones, local pollution and landscape destruction would be sacrificed for corporate profits and, supposedly, the "greater good" of the region. For example, U.S. Steel continued to profit off the zinc plant in Donora until 1957 and Consol Energy used new high-tech long-wall mining techniques to transform landscapes.<sup>33</sup> What is key is that decision-making about which *regional* landscapes would be preserved as parks and which would be sacrificed took place at least in part in offices *in Pittsburgh*. The regional dominance and control that the Pittsburgh industrialists achieved by 1900 was perpetuated through the political and civic elite of the Pittsburgh Renaissance.<sup>34</sup>

The history of Pittsburgh is the history of the region. The Pittsburgh of today has been made possible by centuries of connections with the region around it. Simultaneously, the region has been shaped and reshaped by centuries of connections with Pittsburgh, Appalachia's metropolitan capital.<sup>35</sup> Those connections have not been even, however. Through the centuries, Pittsburgh's corporate and political elites have molded the region to their benefit, extracting value from the land and labor, for profit and recreation. By the 1970s, some city neighborhoods, many commuter suburbs, and highway-connected office parks were on an upward trajectory towards a post-industrial economy. Outlying areas, however, continued to hang on to the declining industrial economy.<sup>36</sup> These trajectories largely continued into the 2000s when shale gas extraction offered

new hope for the declining industrial and agricultural areas in the region.

## PART 2 The “Shale Crescent”

In this history of uneven connections, we see the groundwork for the more recent relationship between Pittsburgh and Appalachia. The past shapes the present. The economic decline or stagnation of much of the region over the last few decades (and the industry language emphasizing it) has made natural gas extraction an economically appealing option, despite the health impacts and environmental consequences.<sup>37</sup> As with the economic activities that came before, shale gas extraction ties the region together. Its growth and the expansion of the petrochemical industry are set to cement those ties for decades to come.

The growth of the natural gas industry in Pennsylvania, West Virginia, and Ohio over the last 10-15 years has brought jobs and other economic benefits to areas that were facing decades of industrial and agricultural decline. On close inspection, the economic impacts have been more limited and mixed than widespread and long-term. In addition, the extraction activities pose environmental and health threats to the areas and communities in which they are located. Like the relationship between Pittsburgh and the region in past historical periods, however, these present ties are not even. Companies in Pittsburgh, Pittsburgh’s suburbs, and outside of the region stand

to benefit while many areas distant from them will bear the brunt of the environmental and health hazards as contemporary “sacrifice zones”.

### **The Growth of Regional Natural Gas Extraction**

As *The Fierce Urgency of Our Environmental Now* highlighted, Allegheny County and other municipal officials recently approved hydraulic fracturing (“fracking”) in some areas of Allegheny County. Even though Pittsburgh and Allegheny County have not yet seen much in the way of well construction, shale gas extraction has expanded substantially throughout the region outside of Allegheny County. The Marcellus shale geological formation extends from southern West Virginia through eastern Ohio and western Pennsylvania and into northeastern Pennsylvania and southern New York. The natural-gas rich Utica geological formation lies deeper than the Marcellus shale and extends farther into New York and Ohio and into Ontario, Canada.<sup>38</sup>

The development of hydraulic fracturing technology in the early 2000s made it possible to access the natural gas in the Marcellus and Utica formations. Since then, natural gas companies have drilled thousands of wells across the Pennsylvania, Ohio, and West Virginia sections of the Marcellus shale. Many of these wells are in forested or agricultural areas in the northeast and southwest corners of Pennsylvania. By 2015, Pennsylvania overtook Texas to become

the leading producer of shale gas, and, in 2016, production for the year surpassed 5 trillion cubic feet. That year, Ohio produced 1.39 trillion cubic feet, and West Virginia 1.21 trillion cubic feet.<sup>39</sup> As of January 2018, there were around 10,200 active hydraulic fracturing wells in Pennsylvania alone, and 1432 plugged or inactive wells.<sup>40</sup>

### *Fracking connections*

As with coal during the industrial era, accessing, extracting, and transporting natural gas has required a vast infrastructure network that has tied sites of extraction to sites of processing, distribution, and consumption. In many remote or rural areas, roads had to be constructed or widened to support the trucks carrying drilling equipment, water, and other materials used in the extraction process. Trains transport fine sand particles used in fracking from their extraction sites in the Midwestern states to drilling locations.<sup>41</sup> Once it is extracted, the natural gas travels through a vast network of pipelines from the drilling sites across fields, forests, and residential areas to compressor stations and to regional or national processing facilities. Through these roads, rails, and pipes, the natural gas industry connects an expansive area throughout western Pennsylvania (*including Allegheny County*), West Virginia, eastern Ohio, and beyond.<sup>42</sup>

### *Petrochemical expansions*

On top of this existing gas extraction, the large supply of a particular type of natural gas in Western Pennsylvania, Ohio, and West Virginia may lead to a large expansion of the petrochemical industry. Much of the gas contains additional natural gas liquids, such as ethane and butane, in addition to methane. These additional liquids can be transformed into other products, such as plastic. Because of the vast supply of this “wet” natural gas and the additional products possible,<sup>43</sup> Shell America (a subsidiary of Netherlands-based Royal Dutch Shell) is constructing an ethane “cracker” plant to transform the ethane bi-product of the natural gas drilling into plastics. According to press reports in 2016, this cracker plant is slated to create 6,000 construction jobs and 600 permanent jobs once complete.<sup>44</sup> Other petrochemical companies, state and local governments, regional economic development organizations, and others are advocating and planning for the construction of at least four additional “cracker” plants, new gas-fired power plants, *and* massive underground storage facilities to hold the ethane from the natural gas.<sup>45</sup>

The proponents of the cracker plants and expanded gas extraction envision the region becoming a new center for the petrochemical industry. Proponents foresee these cracker plants benefitting new or expanded plastics and other downstream industries, leading to jobs and improved economic outcomes.<sup>46</sup> This

vision has led at least one economic development group to market the region as “the shale crescent.”<sup>47</sup> Similarly, because much of the natural gas is planned for export, Sunoco is constructing a second major pipeline from near Pittsburgh to Philadelphia.<sup>48</sup> Over the last 10-15 years, the shale gas extraction industry has rapidly grown in scale and space, and it is poised to grow even more with the expansion of the petrochemical processing industry.

## **Economic impacts**

This growth in the natural gas industry has brought economic inputs to the region over the last 15 years. Again, many communities throughout the Marcellus region were dealing with decades of industrial and agricultural decline. Jobs, royalties, and tax and fee revenues have offered economic hope to some residents and municipalities in the region.

### *Jobs*

When considering the jobs that the natural gas industry has brought, estimates vary greatly depending on how many and which ancillary industries one includes. In 2012, the number of people employed in the oil and natural gas industry in Pennsylvania was at least 30,000. That number was up from around 6,500 a decade earlier.<sup>49</sup> According to the U.S. Bureau of Labor Statistics, the oil and natural gas industry paid out just under \$3 billion in wages in Pennsylvania in

2014, though that amount has declined since then.<sup>50</sup> Even though those 30,000-plus jobs only amounted to less than 1% of Pennsylvania’s total number of jobs,<sup>51</sup> they nonetheless offered employment in more rural, remote, and former industrial areas—many of which had been facing decades of decline. There, many residents, workers, and those leasing land to the extraction companies recognize the environmental and health hazards of natural gas extraction, but see these economic benefits as more important.<sup>52</sup>

### *Royalties, fees, and taxes*

The economic benefits are not limited to jobs, however. Many land-owning residents in all three Marcellus states have also benefitted from leasing their rights to the gas under their properties. This has meant royalty payments to many landowners, including farmers who had been struggling to keep their farms afloat.<sup>53</sup> In Susquehanna, Washington, Bradford, Greene, Lycoming, Wyoming, Tioga, and Butler Counties in Pennsylvania (the state’s leading gas producing counties), for example, landowners leasing their mineral rights received a combined total of \$639 million in 2016 alone, according to a 2018 Pennsylvania Independent Fiscal Office analysis.<sup>54</sup> Furthermore, the State of Pennsylvania receives royalty payments for wells drilled in state forests. Those royalty payments were slated to bring in \$80 million during 2017. That money goes into the state’s Oil and Gas Lease Fund, which supports conservation and

preservation efforts across the state, but also contributes to budget of the Pennsylvania Department of Conservation and Natural Resources.<sup>55</sup>

Pennsylvania, West Virginia, and Ohio have also levied fees and taxes on drilling. Pennsylvania imposes an impact fee on each well drilled. It bases the fee on the average price of natural gas and the time since the well was first drilled. The revenue from these impact fees has amounted to over \$1.4 billion since 2012. Municipalities and counties where drilling is taking place receive 60% of the revenue and are permitted to use the fund for infrastructure, public safety, capital reserve funds, environmental programs, and social and judicial services, among others.<sup>56</sup> The rest goes to state agencies that regulate drilling and to the Marcellus Legacy Fund, a fund dedicated to infrastructure and environmental projects.<sup>57</sup> In 2016, counties and municipalities spent the majority of this money on building their capital reserve funds, public safety, and infrastructure.<sup>58</sup>

To reap the benefit from the drilling, West Virginia and Ohio both levy severance taxes on the volume of gas that companies extract from the ground. In West Virginia, 90% of revenue from the severance tax goes to the West Virginia General Fund. 7.5% goes to oil and gas producing counties and the rest is shared among all of the counties, with the most populous ones receiving the most money. In Ohio, no revenue goes directly to local governments with drilling activity in their jurisdictions. Severance tax revenue is split between the state's Oil and Gas Well

Fund (90% of the revenue) and the state's Geological Mapping Fund (10% of the revenue).<sup>59</sup> The state's Oil and Gas Well Fund goes to capping abandoned wells, administrative expenses of the Division of Oil and Gas Resources Management within the Department of Natural Resources, and "critical and necessary" expenses for "protecting human health and safety and the environment related to oil and gas production".<sup>60</sup>

Through these fees and taxes, Pennsylvania, West Virginia, and Ohio have all generated revenue from the natural gas industry, and Pennsylvania and West Virginia have used it to support local governments where gas extraction has occurred (though to varying degrees). In these ways as well, residents of these states have benefitted, albeit indirectly, from natural gas extraction, even if they did not work in the sector or lease any mineral rights.

## **Contemporary Sacrifice Zones**

On closer look, however, the economic benefits have been mixed. In addition, the growth of gas extraction has brought negative environmental and health outcomes. In this way, areas in the region outside of Pittsburgh and Allegheny County serve as contemporary sacrifice zones.

### *Mixed economic impacts*

In a 2017 report on the effects of Marcellus Shale activity in four Pennsylvania counties, Pennsylvania

State University researchers observed that the economic impact of the industry was mixed. While there were some positive economic changes associated with development, what the impacts were, where they were, and what their size was varied greatly. In general, leases and royalties from drilling had a greater economic impact than employment and compensation, which had only a modest impact. They noted, however, that the economic impact of both of these areas would likely be short-lived, because jobs are most numerous during drilling and the royalty payments are greatest the first few years of a well's operation. Additionally, the economic benefit did not reach everyone. For instance, low-income adults reported that they had encountered difficulties finding higher-paid employment. Economic benefit for some sometimes meant difficulties for others. Low-income adults also reported that they or someone they knew had encountered housing instability because of rising housing costs.<sup>61</sup>

In West Virginia, the economic impacts have been similar: gas extraction has not fully translated to widespread economic improvement. Despite the increase in gas industry jobs there to about 13,000 by the third quarter of 2017,<sup>62</sup> median household income in West Virginia did not increase from 2007 to 2017, and in 2017, the state had fourth highest poverty rate in the country.<sup>63</sup> More specifically, West Virginia's six largest natural-gas-producing counties lost 1,600 jobs across all sectors of the economy from 2014 to 2016 when gas

output was climbing.<sup>64</sup> While the growth of shale gas extraction has led to increased oil and natural gas sector employment and other economic benefits for some people, the benefits have not translated into widespread, long-term economic improvement.

### *Problems with royalties and fees*

Royalty payments and impact fees have also faced scrutiny. Regarding royalty payments, one problem is that many lease contracts between the mineral rights owner and the natural gas companies contain vague or absent language about "post-production costs." These costs pertain to the costs of getting the gas from the well through the pipelines to market. The unclear or missing language in lease contracts has enabled the gas companies to deduct these post-production costs from the royalties they owe the rights owner.<sup>65</sup> This has led to residents receiving less money than they expected and, in some rare cases, being told that they *owe* the gas companies money.<sup>66</sup> Even the Commonwealth of Pennsylvania has been shortchanged by the gas companies' inclusion of these post-production costs and other accounting issues (even though the amount owed is small compared to the amount of revenue that has been generated).<sup>67</sup> Chesapeake Energy has a long history of such practices in northeast Pennsylvania and in Ohio.<sup>68</sup> In West Virginia, Pittsburgh-based EQT has attempted to pay mineral rights owners less by doing two things. As one tactic,

they have deducted post-production costs from royalty payments. As another tactic, they have sued to prevent rights owners from renegotiating their decades-old flat-fee leases to the 12.5% royalty fee lease (based on revenue) common today.<sup>69</sup> Royalty payments have brought large sums of money to many landowners, but natural gas companies have used creative accounting strategies to try to pay out as little as possible.<sup>70</sup>

A second problem with royalty payment benefits is that they do not always remain in local hands. Who owns the land (and mineral rights underneath) and where they live affects how much of the royalty payments end up where the drilling takes place. In Greene County, Pennsylvania in 2012, for example, only about 62% of the land was owned by Green County residents. Out-of-county residents owned 34% of the land. On top of that, only 20% of landowners in Greene County owned about 92% of the land.<sup>71</sup> Even though the royalty payments to land and mineral owners may be large, the economic benefit from these payments is not necessarily felt locally or by the entire population.

Impact fees have not fully lived up to their promise, either. In Pennsylvania, a 2016 audit by the state government revealed that local governments misspent 24% of the revenue they received through impact fees (around \$20 million), meaning that they spent the money they received for things other than what the impact fee law allowed. That \$20 million is in addition to the millions more that go unaccounted for in reporting every year.

Although the impact fee revenue is supposed to be used to mitigate the negative effects of drilling, counties and municipalities have not always used the revenue to that end.<sup>72</sup>

### *Environmental and health impacts*

On top of these mixed economic impacts, environmental and public health in many areas have been “sacrificed” in the name of natural gas extraction. Hydraulic fracturing may negatively affect environments near well and pipeline sites in a variety of ways, including through: the emission of hazardous air pollutants, airborne particulate matter, ozone, and ozone-creating gases; the contamination of groundwater and surface water; erosion; habitat fragmentation; and minor earthquakes.<sup>73</sup> Such environmental impacts have been widespread across Pennsylvania.<sup>74</sup>

In turn, these negative environmental impacts affect public health. Air pollution from hydraulic fracturing is associated with a host of short-term respiratory problems. It also may be linked to long-term problems, such as cancer, cardiovascular disease, and poor birth outcomes.<sup>75</sup> Because of the high number of chemicals used in fracking, drinking, touching, or inhaling (as vapors) contaminated water may affect: sensory organs; the respiratory, gastrointestinal, nervous, immune, cardiovascular, and endocrine systems; the brain; and kidneys. It also may lead to cancer and mutations.<sup>76</sup> In addition, fracking activities have led some residents to feel

increased stress and trauma when their communities and environments were transformed.<sup>77</sup> Residents living close to fracking sites, stations, and pipelines, industry workers, who are often subcontractors, and some livestock have suffered adverse health effects from this activity.<sup>78</sup> Beyond the health effects from chemicals, fracking infrastructure has the potential to explode, risking the lives of people who work or live nearby. In the last few years, several explosions in the region have occurred because of faulty components or land subsidence and erosion.<sup>79</sup> So far, in the areas throughout the region where shale gas extraction has occurred, residents have seen limited and mixed economic benefits and have borne the brunt of the environmental and health impacts of extraction. In addition, several questions about the industry's impact remain, including how many of the jobs have gone to in-state or out-of-state residents, how large the economic and other costs of the negative effects of fracking have been, and how secure the overall financing of the natural gas extraction is.<sup>80</sup>

### **Extractive Extraction**

As when thinking about the uneven historical relationship between Pittsburgh and the wider region, it is important to consider where power lies in the relationship—and where (and who) is sacrificed. When we consider the economic and environmental outcomes and threats of shale gas extraction across the region in comparison to where

companies are located, we see a familiar uneven pattern. Of the top ten well operators in Pennsylvania (by number of wells in 2015):

- Six were based in Pennsylvania.
- Three were based in Texas, including Range Resources Appalachia, the operator with the greatest number of wells in the state.
- One—Chesapeake Appalachia, the operator with the second greatest number of wells—was based in Oklahoma.

Of the six headquartered in Pennsylvania:

- Three were based in Cranberry or near Robinson, but have the majority of their wells in northeast Pennsylvania.
- Three others were based in Pittsburgh or Canonsburg, but have the concentration of their Pennsylvania wells in Greene or Fayette Counties.<sup>81</sup>

In West Virginia, the story is the same. That state's biggest gas producer, Antero Resources, is headquartered in Denver, and the state's second biggest gas producer, EQT, which netted \$1.5 billion in income in 2017 (EQT), is based in Pittsburgh.<sup>82</sup> In these cases where the corporate offices are distant from the sites of extraction (or other shale gas infrastructure), the areas near the sites of extraction see the limited and mixed economic benefits and the environmental costs while the more substantial economic benefits flow to the corporate offices.

In such uneven relationships, companies in the city have attempted to affect fracking operations throughout the



region. In early 2016, in an attempt to prevent a repeat of coal extraction's impact there, Fayette County, West Virginia banned the disposal of fracking waste. The next day, EQT sued the county, claiming that such a ban would stop any gas production in the county. A U.S. district judge overruled the ban, claiming that federal and state statutes took precedence.<sup>83</sup> In late 2017, in a separate case, Fayette County commissioners rejected an application to rezone an area to allow for the construction of a compressor station on a natural gas pipeline. The pipeline developers, including EQT, sued, and again won.<sup>84</sup> Much smaller shale gas-related companies also try to exert their influence over distant landscapes. Reminiscent of Pittsburgh's relationship with the Seneca in the construction of the Kinzua Dam, a company based in Pittsburgh's Lawrenceville neighborhood recently sought to construct a fracking wastewater treatment facility on the Allegheny River in north central Pennsylvania upstream from Pittsburgh *and* the Seneca Nation. After strong opposition from members of the Seneca Nation and local environmental advocates, and concern from several state agencies, the Coudersport Area Municipal Authority rejected the plan.<sup>85</sup> In these cases, Pittsburgh-based companies have used or attempted to use their power to ensure their ability to transform and benefit from distant environments.

Just as was the case during the industrial era of the late 1800s and early 1900s and the Pittsburgh Renaissance of

the mid-to-late 1900s, power over the regional landscape lies far away from many of the sites of extraction. Owners, managers, and other white-collar shale gas workers—many located in the highway-based industrial parks and suburbs (such as Southpointe near Canonsburg, Robinson, and Cranberry) for which Renaissance elites advocated—benefit economically from the distant extraction activities, without having to suffer the immediate adverse impacts of those activities. As West Virginia State Senator Mike Romano complained in the face of a recent bill that would grant concessions to natural gas companies, it's “*déjà vu* for the people who sat here 130 years ago and gave our coal wealth away to out-of-state companies, because we're about to do it again.”<sup>86</sup>

## Conclusion

### The Pittsburgh of Appalachia

For much of its history, Pittsburgh has been the Paris of Appalachia, a central regional metropolis<sup>87</sup> whose political and economic elites have used their power to shape the landscape of the wider region and extract its value. The hydraulic fracturing boom over the last 10-15 years has perpetuated that relationship. Even though many individuals and municipalities in these areas outside of Pittsburgh have seen economic benefits in the form of employment or royalty and impact fee payments, those benefits have been mixed, short-term, and uneven. Moreover, the Appalachian areas with gas extraction, transportation, and processing

infrastructure face short- and long-term environmental threats, posing a health risk to residents—much like the situation in the “patch towns” of the late 1800s and early 1900s. At the same time, those companies based in and near Pittsburgh and the white-collar workers who staff them (not to mention their shareholders and investors) reap the economic benefits from afar while largely not suffering the direct and immediate environmental health threats. Appalachia remains Pittsburgh’s periphery.

### *Becoming a global sacrifice zone*

Thinking more broadly about the future, the expansion of the petrochemical industry partially shifts this relationship between Pittsburgh and Appalachia by transforming the entire region into a sacrifice zone that benefits companies across the world. As mentioned earlier, Shell America, a subsidiary of Netherlands-based Royal Dutch Shell, is constructing an ethane cracker plant northwest of Pittsburgh near Monaca. Investment is coming from Asia, as well. Thailand-based PTT Global Chemical and South Korea-based Daelim Industrial Company have invested \$150 million to construct a separate ethylene cracker plant along the Ohio River in Ohio, just south of Wheeling. The cost of that project might reach \$10 billion.<sup>88</sup> Additionally, in late 2017, China Energy Investment Corporation signed a memorandum of understanding with the State of West Virginia to invest \$83.7 billion in shale gas, power, and chemical

projects in West Virginia over a 20-year period.<sup>89</sup> Although the future of this China Energy investment seemed uncertain in light of the recent trade disputes between the U.S. and China, the deal still appeared to be on track as of the end of August 2018.<sup>90</sup> The high costs of industrial expansion for such large-scale activities most often require the investment of large corporations, such as these.<sup>91</sup>

These investment amounts are substantial and may benefit the regional and state economies through some direct hiring, downstream effects, royalty payments and impact and severance fees. Still, these multinational companies will need to return greater amounts of money through these projects in order to actualize their investments. That means that their long-term revenue needs to exceed the billions of dollars that they are investing into the projects plus the operational and other costs. The continued demand for natural gas to supply the ethane cracker(s) will further entrench the uneven relationship between Pittsburgh and Appalachia. Despite the potential local, state, and regional economic benefits (as vague and mixed as the benefits may be), the residents of the region will face the short and long-term environmental impact that these investments lead to, including the impacts of climate change. In essence, the entire region—both Pittsburgh *and* Appalachia—is becoming a sacrifice zone for the benefit of the global petrochemical industry.

### *Rethinking our relationships*

Pittsburgh, its suburbs, and the wider region will occupy a particular space within an uneven global network. Net economic benefits will flow towards global metropolises while the city and region face the negative environmental outcomes. Pittsburgh, the Paris of Appalachia, is not Paris, a global metropolis. Economically, politically, and environmentally, Pittsburgh is the Pittsburgh of Appalachia, a semi-peripheral node within a global political-economic hierarchy that has an extractive relationship with its own periphery, Appalachia. That is, within a power hierarchy of cities across the world, Pittsburgh is just in the middle and it dominates the region around it.

As we think about and grapple with the environmental challenges facing our city, region, and Earth, we need a broader understanding of Pittsburgh and the Pittsburgh region. We need to account for the ways that various environmental, economic, political, and social processes bind what happens in Pittsburgh and Allegheny County with what happens in more rural counties in the region—and what happens farther afield with what happens in the city. Such an interconnected approach also requires recognizing how Pittsburgh and the region fit into national and global processes. Indeed, the city's environmental past, present, and future are bound up with the region's environmental past, present, and future. As such, environmentalists in Pittsburgh

and its suburbs need to recognize this uneven history and work *with* (not for) their regional counterparts to build alliances and alternatives that seek healthful, prosperous, secure, and mutually beneficial futures.

## References

- <sup>1</sup> Koepfinger, Eoin. (2012, October 22). Chuck Kinder, a man without guiding principles. *Sampsonia Way Magazine*. City of Asylum/Pittsburgh. Retrieved from: <http://www.sampsoniaway.org/literary-voices/2012/10/22/chuck-kinder-a-man-without-guiding-principles/>.
- <sup>2</sup> Frankel, Todd C. (2017, June 6). In 'The Paris of the Appalachians,' they're not buying Trump's talk. *The Washington Post*. WP Company LCC. Retrieved from: [https://www.washingtonpost.com/business/economy/in-the-paris-of-the-appalachians-theyre-not-buying-trumps-climate-talk/2017/06/06/6f3ddd8a-49f9-11e7-bc1b-fddb8359dee\\_story.html](https://www.washingtonpost.com/business/economy/in-the-paris-of-the-appalachians-theyre-not-buying-trumps-climate-talk/2017/06/06/6f3ddd8a-49f9-11e7-bc1b-fddb8359dee_story.html).
- <sup>3</sup> O'Neill, Brian. (2009). *The Paris of Appalachia*. Pittsburgh, USA: Carnegie Mellon University Press. p. 22; Glaeser, Edward L.; Kahn, Matthew; and Chu, Chenguan. (2001, July) Job sprawl: employment location in U.S. metropolitan areas. Survey Series. Center on Urban and Metropolitan Policy. Brookings Institution. Cited in O'Neill, B. (2009) *The Paris of Appalachia*. p. 22.
- <sup>4</sup> See, for example, Bill Flanagan's comments on shale gas in Huffaker, Christopher. (2018, May 8) Think you know what the region's economy did in the last decade? Try charting it. *Pittsburgh Post-Gazette*. News interactive feature. PG Publishing Co. Retrieved from: <https://newsinteractive.post-gazette.com/blog/do-you-know-what-the-pittsburgh-economy-over-the-last-decade-really-looked-like-try-your-hand/>.
- <sup>5</sup> Small, Andrew. (2017, June 2). The Pittsburgh area really did vote for Trump. *CityLab*. The Atlantic Monthly Group. Retrieved from: <https://www.citylab.com/equity/2017/06/peduto-trump-election-paris-climate-change/529029/>.
- <sup>6</sup> See: Baka, Jennifer and Bailis, Robert. (2014) Wasteland energy-scapes: a comparative energy flow analysis of India's biofuel and biomass economies. *Journal of Ecological Economics* 108. p 8–17. <http://dx.doi.org/10.1016/j.ecolecon.2014.09.022>; Breetz, Hanna L. (2017) Political-industrial ecology: integrative, complimentary, and critical approaches. *Geoforum* 85, p. 392-395.; Bridge, Gavin. (2009) Material worlds: natural resources, resource geography and the material economy. *Geography Compass* 3, 3. p. 1217–1244. <http://dx.doi.org/10.1111/j.1749-8198.2009.00233.x>; Bridge, Gavin. (2008) Global production networks and the extractive sector: governing resource-based development. *Journal of Economic Geography* 8, 3. p. 389–419. <http://dx.doi.org/10.1093/jeg/lbn009>; Cousins, Joshua J. (2017) Of floods and droughts: the uneven politics of stormwater in Los Angeles. *Political Geography* 60. p. 34-46.; Cousins, Joshua J. and Newell, Joshua P. (2015) A political-industrial ecology of water supply infrastructure in Los Angeles. *Geoforum* 58. p. 38-50.; Guibrinet, Louise; Sanzana Calvet, Martin; and Castán Broto, Vanesa. (2017) Flows, system boundaries and the politics of urban metabolism: waste management in Mexico City and Santiago de Chile. *Geoforum* 85. p. 353-367.; Huber, Matthew T. (2017) Hidden abodes: industrializing political ecology. *Annals of the Association of American Geographers* 107, 1. p. 151–166. <http://dx.doi.org/10.1080/24694452.2016.1219249>; Huber, Matthew. (2017) Reinvigorating class in political ecology: nitrogen capital and the means of degradation. *Geoforum* 85, p. 345-352. <http://dx.doi.org/10.1016/j.geoforum.2017.01.010>; Newell, Joshua Peter; Cousins, Josh; and Baka, Jen. (2017) Political-industrial ecology: an introduction. *Geoforum* 85.; Newell, Joshua P. and Cousins, Joshua J. (2015) The boundaries of urban metabolism: towards political-industrial ecology. *Progress in Human Geography* 39, 6. p. 702-728.; Swyngedouw, Erik. (2004) *Social Power and the Urbanization of Water: Flows of Power*. Oxford: Oxford University Press.; Swyngedouw, Erik and Heynen, Nik. (2003) Urban political ecology, justice and the politics of scale. *Antipode*. p. 898–918.
- <sup>7</sup> Due to time and length limitations, this paper only presents some of the many issues related to the relationship between Pittsburgh and the wider Appalachia region, historically and in terms of shale gas extraction. Most notably, the role of the federal, state, and local governments in enabling industrial projects is not included. Neither is a discussion about the financing of gas extraction. This paper is meant to be an introductory exploration of spatial dimensions of power and uneven development in contemporary gas extraction. More detailed research on these issues to further substantiate claims is warranted.

- 
- <sup>8</sup> For example: Cronin, William. (1991). *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton.
- <sup>9</sup> Dieterich-Ward, Allen. (2017) *Beyond Rust: Metropolitan Pittsburgh and the Fate of Industrial America*. Philadelphia: Oxford University Press.; McCollester, Charles. (2008) *The Point of Pittsburgh: Production and Struggle at the Forks of the Ohio*. Pittsburgh, USA: Battle of Homestead Foundation.; Muller, Edward K. and Tarr, Joel A. (2003) The interaction of natural and built environments in the Pittsburgh landscape. In Tarr, Joel A., ed. *Devastation and Renewal*. Pittsburgh, USA: University of Pittsburgh Press. p. 11-40.
- <sup>10</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 29-31.
- <sup>11</sup> Dieterich-Ward. (2017) *Beyond Rust*.
- <sup>12</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 40-45.; McCollester. (2008) *The Point of Pittsburgh*.
- <sup>13</sup> Muller and Tarr. (2003) The interaction of natural and built environments. p. 19-20.; McCollester. (2008) *The Point of Pittsburgh*. p. 60, 86.
- <sup>14</sup> Muller and Tarr. (2003) The interaction of natural and built environments. p. 20.; Guilford, Gwynn. (2017, December 30). The 100-year capitalist experiment that keeps Appalachia poor, sick, and stuck on coal. *Quartz*. Quartz Media, Inc. Retrieved from: <https://qz.com/1167671/the-100-year-capitalist-experiment-that-keeps-appalachia-poor-sick-and-stuck-on-coal/>.
- <sup>15</sup> Muller and Tarr. (2003) The interaction of natural and built environments. p. 21.
- <sup>16</sup> McCollester. (2008) *The Point of Pittsburgh*. p. 86; Dieterich-Ward. (2017) *Beyond Rust*. p. 35.
- <sup>17</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 35.
- <sup>18</sup> Muller and Tarr. (2003) The interaction of natural and built environments. p. 23-24.
- <sup>19</sup> Muller and Tarr. (2003) The interaction of natural and built environments. p. 23-24.
- <sup>20</sup> Muller and Tarr. (2003) The interaction of natural and built environments. p. 23, 47. Muller, Edward K. (2003) River City. In Tarr, Joel A., ed. *Devastation and Renewal*. Pittsburgh, USA: University of Pittsburgh Press. p. 41-63. p. 53, 56, 60.
- <sup>21</sup> Muller. (2003) River City. p. 56.
- <sup>22</sup> Chronology of national forests established under the Weeks Act. (n.d.) The Forest History Society. Retrieved from: <https://foresthistor.org/research-explore/us-forest-service-history/policy-and-law/the-weeks-act/chronology-national-forests-established-weeks-act/>.
- <sup>23</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 6.
- <sup>24</sup> Gugliotta, Angela. (2003) How, when, and for whom was smoke a problem in Pittsburgh? In Tarr, Joel A., ed. *Devastation and Renewal*. Pittsburgh, USA: University of Pittsburgh Press. p. 110-125. p. 117-121.
- <sup>25</sup> McCollester. (2008) *The Point of Pittsburgh*. p. 343.
- <sup>26</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 75-89.; McCollester. (2008) *The Point of Pittsburgh*. p. 342-344.
- <sup>27</sup> McCollester. (2008) *The Point of Pittsburgh*. p. 346-347.
- <sup>28</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 77-78.
- <sup>29</sup> McCollester. (2008) *The Point of Pittsburgh*. p. 346-347.
- <sup>30</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 80.; McCollester. (2008) *The Point of Pittsburgh*. p. 345.
- <sup>31</sup> Hauptman, Laurence Marc. (2014) *In the Shadow of Kinzua*. Syracuse, USA: Syracuse University Press. p. xv.
- <sup>32</sup> McCollester. (2008) *The Point of Pittsburgh*. p. 345.; Dieterich-Ward. (2017) *Beyond Rust*. p. 81.
- <sup>33</sup> McCollester. (2008) *The Point of Pittsburgh*. p. 346.; Dieterich-Ward. (2017) *Beyond Rust*.
- <sup>34</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 124-125.

- <sup>35</sup> Widner, Ralph R. (1973, November 26) The regional city: an approach to planning our future urban growth, an address to the annual meeting of the Allegheny Conference on Community Development. p. 1-25. In Dieterich-Ward. (2017) *Beyond Rust*. p. 94.
- <sup>36</sup> Dieterich-Ward. (2017) *Beyond Rust*. p. 150; Widner. (1973) The regional city. In Dieterich-Ward. (2017) *Beyond Rust*. p. 94-96.
- <sup>37</sup> Hudgins, Anastasia. (2013) Fracking's future in a coal mining past: subjectivity undermined. *Culture, Agriculture, Food and Environment* 35, 1. p. 54-59. DOI: 10.1111/cuag.12005.; Kriesky, J.; Goldstein, B.D.; Zell, K.; and Beach, S. (2013) Differing opinions about natural gas drilling in two adjacent counties with different levels of drilling activity. *Energy Policy* 58, 228-236.; Malin, Stephanie. (2014) There's no real choice but to sign: neoliberalization and normalization of hydraulic fracturing on Pennsylvania's farmland. *Journal of Environmental Studies and Sciences* 4. p. 17-27.; McLaughlin, Danielle M. and Cutts, Bethany B. (2018) Neither knowledge deficit nor NIMBY: understanding opposition to hydraulic fracturing as a nuanced coalition in Westmoreland County, Pennsylvania (USA). *Environmental Management* 62. p. 305-322.
- <sup>38</sup> Maps and graphics. (2018) Marcellus Center for Outreach and Research. The Pennsylvania State University. Retrieved from: <http://www.marcellus.psu.edu/resources-maps-graphics.html>.
- <sup>39</sup> Pickenpaugh, Gavin C. and Adder, Justin M. (2018, August) Shale gas production and labor market trends in the U.S. Marcellus-Utica region over the last decade. *Monthly Labor Review*, U.S. Bureau of Labor Statistics. Retrieved from: <https://doi.org/10.21916/mlr.2018.20>. p. 3.
- <sup>40</sup> This is the number of wells, not the number of well pads. Each well pad may hold multiple wells. Kelso, Matt. (2019, January 8) Pennsylvania Drilling Trends in 2018. FracTracker Alliance. Retrieved from: <https://www.fractracker.org/2019/01/pennsylvania-drilling-trends-2018/>; PA Shale Viewer. (2018, October 25) FracTracker Alliance. Retrieved from: <https://www.fractracker.org/map/us/pennsylvania/pa-shale-viewer/>; Amico, Chris. (n.d.) Shale play: About the data. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/shale-play-about-the-data/>.
- <sup>41</sup> Frac Sand Mining. (n.d.) FracTracker Alliance. Retrieved from: <https://www.fractracker.org/categories/by-content/frac-sand-mining/>; Morrison, Oliver. (2018, August 2) From Shenango site to Shell cracker plant: a tour of the region's industrial sites. PublicSource. PublicSource. Retrieved from: <https://www.publicsource.org/from-shenango-site-to-shell-cracker-plant-a-tour-of-the-regions-industrial-and-environmental-sites/>.
- <sup>42</sup> Shamer, Sierra. (2016, June 28) Infrastructural Challenges: The Direction of Drilling, Pipelines, and Politics in Pennsylvania. FracTracker Alliance. Retrieved from: <https://www.fractracker.org/2016/06/pipeline-build-out/>.
- <sup>43</sup> What's the difference between wet and dry natural gas? (n.d.) StateImpact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/tag/natural-gas-prices/>.
- <sup>44</sup> Conti, David. (2016, July 7) Shell moves ahead with ethane cracker in Beaver County. *TribLive*. Trib Total Media. Retrieved from: <https://triblive.com/business/headlines/10592709-74/shell-company-announced>.
- <sup>45</sup> The Appalachian storage hub. (2018, Jan 25) Power of 32. Retrieved from: <https://powerof32.org/news-updates/appalachian-storage-hub/>; Initiative: Promote economic activity based on shale gas. (n.d.) Power of 32. Retrieved from: <https://powerof32.org/initiatives/promote-economic-activity-based-upon-shale-gas/>; Carter, Kristin M.; Patchen, Douglas G.; Moore, Jessica P.; Fakhari, Mohammad; Daft Jr., Gary W; Solis, Michael; Dunst, Brian J.; Anthony, Robin V.; Schmid, Katherine W.; Metz, Kyle; Dinterman, Philip; Bloxson, Julie M.; Schubert, Erica N.; Saucer, John. (2017, July 31) *A Geological Study to Determine the Potential to Create and Appalachia Storage Hub for Natural Gas Liquids*. Appalachian Oil & Natural Gas Research Consortium.
- <sup>46</sup> Reports and plans released for enhancing petrochemicals, plastics manufacturing in Pennsylvania. (2017, March 20) Team Pennsylvania Foundation. Retrieved from: <https://teampa.com/2017/03/new-study-highlights-petrochemical-manufacturing-opportunities->

pennsylvania/.; Frazier, Reed. (2017, March 23) Is a petrochemical boom heading for Pennsylvania? *The Allegheny Front*. Allegheny Front. Retrieved from: <https://www.alleghenyfront.org/is-a-petrochemical-boom-heading-for-pennsylvania/>; Huba, Stephen. (2017, September 28) Ethane plant in Beaver County could lead to ‘manufacturing resurgence’ across the region. TribLive. Trib Total Media. Retrieved from: <https://triblive.com/local/regional/12783739-74/ethane-plant-in-beaver-county-could-lead-to-manufacturing-resurgence-across-the>.

<sup>47</sup> ShaleCrescent USA: The Ohio Valley Energy Advantage (n.d.) Shale Crescent USA. Retrieved from: <https://shalecrescentusa.com/>.

<sup>48</sup> Shamer, Sierra. (2016, June 3) Infrastructural Challenges.

<sup>49</sup> Foran, Claire. (2014, April 14) How many jobs does fracking really create? *The Atlantic*. The Atlantic Monthly Group. Retrieved from: <https://www.theatlantic.com/politics/archive/2014/04/how-many-jobs-does-fracking-really-create/445227/>.

<sup>50</sup> Pickenpaugh, G. C. and Adder, J. M. (2018) Shale gas production and labor market trends. p. 18.; See also: Cruz, Jennifer; Smith, Peter W.; and Stanley, Sarah. (2014, February) The Marcellus Shale gas boom in Pennsylvania: employment and wage trends. *Monthly Labor Review*. U.S. Bureau of Labor Statistics. Retrieved from: <https://doi.org/10.21916/mlr.2014.7>.

<sup>51</sup> Foran, C. (2014, April 14) How many jobs does fracking really create?

<sup>52</sup> Kriesky, J., et al. (2013) Differing opinions about natural gas drilling; Malin, S. (2014) There’s no real choice but to sign.

<sup>53</sup> Cusick, Marie and Sisk, Amy. (2018, February 28) Royalties: why some strike it rich in the natural gas patch, and others strike out. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2018/02/28/why-some-strike-it-rich-in-the-gas-patch-and-others-strike-out/>.

<sup>54</sup> Cusick, Marie. (2018, March 22) Report: Severance tax proposal could cost mineral owners millions. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2018/03/22/report-severance-tax-proposal-could-cost-mineral-owners-millions/>.

<sup>55</sup> Cusick, Marie. (2017, February 24) Forest drilling to generate \$80 million this year. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2017/02/24/forest-drilling-to-generate-80-million-this-year/>; Cusick, Marie. (2018, May 17) Environmental group: Wolf is ignoring Supreme Court decision, misusing money from gas drilling. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2018/05/17/enviro-group-wolf-is-ignoring-supreme-court-decision-misusing-money-from-gas-drilling/>.

<sup>56</sup> Pennsylvania Public Utility Commission. (n.d.) Disbursements and impact fees. Pennsylvania Public Utility Commission. Retrieved from: <https://www.act13-reporting.puc.pa.gov/Modules/PublicReporting/Overview.aspx>.

<sup>57</sup> The oil and gas law of the land: Act 13. (n.d.) State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/tag/act-13/>; Cusick, Marie. (2018, June 21) Pennsylvania’s gas impact fees to rise to \$209 million this year. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2018/06/21/pennsylvanias-gas-impact-fees-rise-to-209-million-this-year/>.

<sup>58</sup> Pennsylvania Public Utility Commission. (n.d.) Disbursements and impact fees.

<sup>59</sup> Marie, Chloe. (2017, December 6) Shale law in the spotlight: natural gas severance taxes in the United States. Penn State Shale Law Blog. Pennsylvania State University Center for Agricultural and Shale Law. [Web log]. Retrieved from: <http://www.pennstateshalelaw.com/2017/12/shale-law-in-spotlight-natural-gas.html>.

<sup>60</sup> 15 Ohio Revised Code. § 1509.02. (2018) Division of oil and gas resources management; chief; oil and gas well fund. Retrieved from: <http://codes.ohio.gov/orc/1509.02>; 57 Ohio Revised Code. §

5749.02. (2017) Imposing a tax on severance of natural resources. Retrieved from: <http://codes.ohio.gov/orc/5749.02>.

<sup>61</sup> Brasier, Kathryn; Chandler, Raeven; Glenna, Leland; Hesse, Arielle; Kelsey, Timothy; Monnat, Shannon; Perchinski, Joshua; Schafft, Kai; and Suchyta, Mark. (2017 March) *The Marcellus Shale Impacts Study Wave 2: Chronicling Social and Economic Change in Northern and Southwestern Pennsylvania*. The Pennsylvania State University. The Center for Rural Pennsylvania. Retrieved from: [http://www.rural.palegislature.us/documents/reports/Marcellus\\_Wave\\_2\\_Final\\_Report\\_2017.pdf](http://www.rural.palegislature.us/documents/reports/Marcellus_Wave_2_Final_Report_2017.pdf). p. iii-iv.

<sup>62</sup> West Virginia Commerce Department figure cited in Ward Jr., Ken. (2018 April 27) The coal industry extracted a steep price from West Virginia. Now natural gas is leading the state down the same path. *The Charleston Gazette-Mail*. In ProPublica. 2018. Retrieved from: <https://www.propublica.org/article/west-virginia-coal-industry-rise-of-natural-gas>.

<sup>63</sup> O'Leary, Sean. (2018 September 13) Census data shows lack of progress for West Virginia. West Virginia Center on Budget & Policy. [Web log]. Retrieved from: <https://wvpolicy.org/census-data-shows-lack-of-progress-for-west-virginia/>.

<sup>64</sup> O'Leary, Sean. (2018 February 12). Booms and bust: natural gas update. West Virginia Center on Budget & Policy. [Web log]. Retrieved from: <https://wvpolicy.org/booms-and-bust-natural-gas-update/>.

<sup>65</sup> Cusick, M. and Sisk, A. (2018) Royalties: why some strike it rich.

<sup>66</sup> Cusick, Marie. (2016, October 14) Bradford County releases video slamming Chesapeake Energy. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2016/10/14/bradford-county-releases-video-slamming-chesapeake-energy/>; Cusick, Marie. (2013, June 2017) Bradford County landowners accuse Chesapeake of underpaying royalties. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2013/06/17/landowners-dispute-chesapeake-royalty-payments-in-bradford-county/>.

<sup>67</sup> Cusick, Marie. (2017, February 26) Pa. owed 'hundreds of thousands of dollars' in royalties from forest drilling. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2017/02/26/pa-owed-hundreds-of-thousands-of-dollars-in-royalties-from-forest-drilling/>.

<sup>68</sup> Cusick, Marie. (2014, November 24) As fraud allegations mount against Chesapeake Energy, so does frustration. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2014/11/24/as-fraud-allegations-mount-against-chesapeake-energy-so-does-frustration/>; Deduction of post-production expenses from royalty payments in Ohio. (2017, November 2) Legal perspective: energy & natural resources. Babst Calland. Babst, Calland, Clements and Zomnir, P.C. Retrieved from: <http://www.babstcalland.com/wp-content/uploads/Deduction-of-Post-Production-Expenses-from-Royalty-Payments-in-Ohio.pdf>.

<sup>69</sup> Ward Jr., Ken. (2018, November 13) West Virginia's natural gas industry keeps pushing to whittle away payments to residents. *The Charleston Gazette-Mail*. In ProPublica. 2018. Retrieved from: <https://www.propublica.org/article/west-virginias-natural-gas-industry-pushes-to-reduce-royalties>.

<sup>70</sup> Lustgarten, Abrahm. (2013, August 13) Unfair share: how oil and gas drillers avoid paying royalties. ProPublica. Pro Publica Inc. 2018. Retrieved from: <https://www.propublica.org/article/unfair-share-how-oil-and-gas-drillers-avoid-paying-royalties>.

<sup>71</sup> Kelsey, Timothy W.; Metcalf, Alex; and Salcedo, Rodrigo. (2012). Marcellus Shale: land ownership, local voice, and the distribution of lease and royalty dollars. Penn State: Center for Economic and Community Development. CECD Research Paper Series. Cited in Herzenberg, Stephen; Polson, Diana; and Price, Mark. (2014, April) *Measuring the cost and benefit of natural gas development in Greene County, Pennsylvania: a case study*. Multi-State Shale Research Collaborative. Retrieved from: <https://pennbpc.org/sites/pennbpc.org/files/greeneCASESTUDY.pdf>.



- 
- <sup>72</sup> Cusick, Marie. (2016, December 6) Audit criticizes local governments' use of impact fee revenue. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2016/12/06/audit-criticizes-local-governments-use-of-gas-impact-fee-revenue/>.
- <sup>73</sup> Environmental impacts of natural gas. (n.d.) Union of Concerned Scientists. Retrieved from: <https://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/environmental-impacts-of-natural-gas>.
- <sup>74</sup> Troutman, Melissa A.; Shamer, Sierra; and Pribanic, Joshua B. (2017, January 23) Hidden data suggests fracking created widespread, systemic impact in Pennsylvania. Public Herald. Public Herald. Retrieved from: <http://publicherald.org/hidden-data-suggests-fracking-created-widespread-systemic-impact-in-pennsylvania/>; Health risks in Pennsylvania from oil and gas air pollution. (2018, December) Clean Air Task Force. Fact sheet. Clean Air Task Force. Retrieved from: <https://www.catf.us/wp-content/uploads/2018/12/factsheet-PA-update.pdf>; Cusick, Marie. (2017, September 1) Overall methane emissions from shale industry rise, other air pollutants down. State Impact Pennsylvania. WITF. Retrieved from: <https://stateimpact.npr.org/pennsylvania/2017/09/01/methane-emissions-from-shale-industry-rise-other-air-pollutants-down/>.
- <sup>75</sup> Air. (n.d.) Southwest Pennsylvania Environmental Health Project. EHP. Retrieved from: <https://www.environmentalhealthproject.org/health-issues/air>.
- <sup>76</sup> Water. (n.d.) Southwest Pennsylvania Environmental Health Project. EHP. Retrieved from: <https://www.environmentalhealthproject.org/health-issues/water>.
- <sup>77</sup> Perry, Simona. (2012) Development, land use, and collective trauma. *Culture, Agriculture, Food, and Environment* 34, 1. 81-92. DOI: 10.1111/j.2153-9561.2012.01066.x. This connection between fracking and stress is increasingly well-documented. See: Mental health literature review: unconventional oil and gas development. (2018 July) Southwest Pennsylvania Environmental Health Project. EHP. Retrieved from: <https://www.environmentalhealthproject.org/sites/default/files/assets/resources/mental-health-and-uogd-7.28.18.pdf>.
- <sup>78</sup> Noble, Justin. (2018, March 13) 'The harms of fracking': New report details increased risk of asthma, birth defects, and cancer. *Rolling Stone*. Rolling Stone. Retrieved from: <https://www.rollingstone.com/politics/politics-news/the-harms-of-fracking-new-report-details-increased-risks-of-asthma-birth-defects-and-cancer-126996/>; Cantarow, Ellen. (2013, May 2) Fracking ourselves to death in Pennsylvania. *The Nation*. The Nation Company. Retrieved from: <https://www.thenation.com/article/fracking-ourselves-death-pennsylvania/>; Guilford, G. (2017). The 100-year capitalist experiment.; For a bibliography of Pennsylvania-related health studies, see: Compilation of UNGD health studies using Pennsylvania data. (2018, December 17) Southwest Pennsylvania Environmental Health Project. Retrieved from: <https://www.environmentalhealthproject.org/sites/default/files/assets/resources/pa-studies-12.17.18.pdf>.
- <sup>79</sup> Litvak, Anya. (n.d.) Unstable ground: Pipeline ruptures and drilling problems bring new scrutiny to Pennsylvania's pockmarked geology. *Pittsburgh Post-Gazette*. News interactive feature. PG Publishing Co. Retrieved from: <https://newsinteractive.post-gazette.com/mariner-east-2-pipeline-subsidence/>; Litvak, Anya and Legere, Laura. (n.d.) The lessons of Mariner East 2: Pa. regulators were braced for water woes and complaints. But they didn't expect all those spills. *Pittsburgh Post-Gazette*. News interactive feature. PG Publishing Co. Retrieved from: <https://newsinteractive.post-gazette.com/mariner-east-2-pipeline-horizontal-directional-drilling/>.
- <sup>80</sup> For discussions of the financing of the natural gas industry, see: McLean, Bethany. (2018) *Saudi America: The truth about fracking and how it's changed the world*. New York: Columbia Global Reports.; Mikulka, Justin. (2018 April 18) The secret of the great American fracking bubble. DeSmog. Retrieved from: <https://www.desmogblog.com/2018/04/18/finances-great-american-fracking-bubble>.

- 
- <sup>81</sup> It should be noted that Range Resources Appalachia does have an office in Canonsburg, Washington County, Pennsylvania, which is in the same county as most of its wells. Range Resources Appalachia is the only one of the top ten well operators for which such proximity is the case. Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Shale play: Natural gas drilling in Pennsylvania. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Chesapeake Appalachia, LLC. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/chesapeake-appalachia-llc/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) EQT Production Co. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/eqt-production-co/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Cabot Oil & Gas Corp. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/cabot-oil-gas-corp/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Swepi LP. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/swepi-lp/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Talisman Energy USA Inc. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/talisman-energy-usa-inc/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Chevron Appalachia LCC. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/chevron-appalachia-llc/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Southwestern Energy Production Co. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/southwestern-energy-prod-co/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) Anadarko E&P Co LP. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/anadarko-ep-co-lp/>; Amico, Chris; DeBelius, Danny; Detrow, Scott; and Stiles, Matt. (2015) CNX Gas Co LLC. State Impact Pennsylvania. WITF. Retrieved from: <http://stateimpact.npr.org/pennsylvania/drilling/operators/cnx-gas-co-llc/>; S&P Global Market Intelligence. (2019, January 10). Company overview of Range Resources-Appalachia, LLC. Bloomberg L.P. Retrieved from: <https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=4272073>.
- <sup>82</sup> Ward Jr., K. (2018) The coal industry extracted.
- <sup>83</sup> Ward Jr., Ken. (2018, May 4) One West Virginia county tried to break its dependence on the energy industry. It was overruled. *The Charleston Gazette-Mail*. In ProPublica. 2018. Retrieved from: <https://www.propublica.org/article/fayette-county-west-virginia-energy-natural-gas-coal-dependence>.
- <sup>84</sup> Ward Jr., Ken. (2018, August 30) Natural gas industry again beats a tiny West Virginia County that wanted to control its destiny. *The Charleston Gazette-Mail*. In ProPublica. 2018. Retrieved from: <https://www.propublica.org/article/natural-gas-industry-beats-a-tiny-west-virginia-county>.
- <sup>85</sup> Hopey, Don. (2018, March 18) At Allegheny River's headwaters, treatment plant for fracking wastewater stirs debate. *Pittsburgh Post-Gazette*. PG Publishing Co. Retrieved from: [https://www.post-gazette.com/business/powersource/2018/03/18/Seneca-Nation-Allegheny-River-shale-gas-fracking-drilling-wastewater-epiphany-pittsburgh-potter/stories/201803080213/](https://www.post-gazette.com/business/powersource/2018/03/18/Seneca-Nation-Allegheny-River-shale-gas-fracking-drilling-wastewater-epiphany-pittsburgh-potter/stories/201803080213;); Home. (n.d.) Save the Allegheny. Retrieved from: [http://savetheallegheny.org/index.php/about](http://savetheallegheny.org/index.php/about;); Defend Ohi:yo. (n.d.) Seneca Media and Communications Center. Retrieved from: <https://defendohiyo.org/>.
- <sup>86</sup> Ward Jr., K. (2018) The coal industry extracted.; See also Guilford, G. (2017) The 100-year capitalist experiment.
- <sup>87</sup> Widner, R. (1973) The regional city. In Dieterich-Ward. (2017) *Beyond Rust*. p. 94-96.

---

<sup>88</sup> Junkins, Casey. (2018, March 12) Updated: Kasich says Belmont County cracker partnership pushed price tag to \$10 billion. *The Intelligencer. Wheeling News Register*. The Intelligencer. Retrieved from: <http://www.theintelligencer.net/news/top-headlines/2018/03/kasich-confirms-daelims-partnership-with-ptt-global-chemical/>.

<sup>89</sup> Meng, Meng and Mason, Josephine. (2017, November 9) China Energy Investment signs MOU for \$83.7 billion in West Virginia projects. *Reuters*. Thomson Reuters. Retrieved from: <https://www.reuters.com/article/us-trump-asia-energy-west-virginia/china-energy-investment-signs-mou-for-83-7-billion-in-west-virginia-projects-idUSKBN1D90S9>.

<sup>90</sup> Holland, Bill. (2018, August 28) Chinese energy executive says \$84 billion investment in West Virginia still on track. *S&P Global Platts*. S&P Global. Retrieved from: <https://www.spglobal.com/platts/en/market-insights/latest-news/natural-gas/082818-chinese-energy-executive-says-84-billion-investment-in-west-virginia-still-on-track>.

<sup>91</sup> Andrews, Eleanor and McCarthy, James. (2014) Scale, shale, and the state: political ecologies and legal geographies of shale gas development in Pennsylvania. *Journal of Environmental Studies and Sciences* 4. p 7-16. DOI 10.1007/s13412-013-0146-8.